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OVIPOSITORS OF CICADELLIDÆ (HOMOPTERA).....*P. A. Readio.*

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VOL. XIV.] OCTOBER, 1922. [NO. 8.

The Ovipositors of the Cicadellidæ (Homoptera).

By PHILIP A. READIO.

Submitted to the department of entomology and to the graduate faculty of the University of Kansas in partial fulfillment of the requirements for the degree of master of science, May 15, 1922.

INTRODUCTION.

THE primary purpose of this paper is to determine whether or not the ovipositors of the Cicadellidæ possess characters of value in classification, and if so, of how much value these characters are and how accessible they are to the general worker. To Prof. Paul B. Lawson belongs the credit for suggesting the paper. In the same group he has recently found that the male genitalia are of much value in classification, and the possibility of equal value in the female genitalia occurred to him. Miss Itasca Hilsman, working in the closely related family, Cicadidæ, found that the ovipositors in this group "afford constant and ready characters which may at times be of decided value to him (the specialist) in the determination of closely related species." Hence it was natural to expect that equally favorable results might be obtained from a study of the ovipositors of the Cicadellidæ. As an introduction to the taxonomic part of the paper, a morphological study of the abdomen of the female and the structure of the ovipositor was made.

In addition to the reasons already stated, there are certain general considerations which would lead one to expect such an investigation as this one to be fruitful. It is constant characters that the taxonomist is in search of—characters that are sufficiently definite to separate closely related species, and yet are present in the entire range of the species. Because of their internal position, genitalia are more likely to be constant than external structures, which may vary with differences of environment. The constancy of the use to which genitalia are put also makes for the permanency of their structure and their usefulness as taxonomic characters.

The material necessary for this study was obtained from the duplicate collection of the University of Kansas entomological museum. A representative number of ovipositors from each of the subfamilies, excepting the Paropinæ, was examined, and an attempt made to examine as many different genera and as many species in each genus as possible. In all, representatives of forty-eight genera and ninety-two species were examined and figured.

The writer wishes to express to Prof. S. J. Hunter his appreciation of the sanction given to this work, and of the necessary time and materials so kindly placed at his disposal. To Prof. P. B. Lawson many thanks are due, both for the conception of the nature of the problem and for the direction of the work to its completion. It was under the able direction of Prof. P. W. Claassen, of Cornell University, that the photography was done. To Prof. H. B. Hungerford, Miss Lucy Hackman, Miss Kathleen Doering and Mr. Robert Guntert the writer wishes to express his appreciation for their kind help, suggestions and criticisms.

THE ABDOMEN OF THE FEMALE.

(Pl. XXI, figs. 1-3.)

For a study of the abdomen of the female leaf hopper, dried specimens of *Oncometopia lateralis* (Fabricius) were used. These were soaked in caustic potash, ten per cent, for twenty-four hours, and drawings and descriptions made from the cleared specimens.

The abdomen joins the thorax broadly, bulges slightly in the middle, and, from a point a little past the middle, tapers both in width and in height to a blunt, caudal point. A cross section has a general semicircular outline. The tergum is arched, appears dorsally and laterally, and forms the rounded portion of the semicircle, while the pleura and sternum are flat, and form the flat, ventral portion. The lateral edges of the sternum are bent slightly dorsad at their union with the pleura. The pleura and tergum unite at a distinct but slightly rounded angle.

Eleven segments can be accounted for in the abdomen. Of these, segments one and two lack distinct pleura, and segments eight to eleven are variously modified as described.

The tergum of the first segment is partly membranous and partly chitinized. Cephalad, at its junction with the metathorax, it is entirely membranous. Caudad, at its junction with the second abdominal segment, is a narrow, linear, chitinized sclerite which bears laterally two inwardly projecting processes along its cephalic border.

Between the inwardly projecting processes is a round, small, chitinized piece. The pleura are entirely membranous, and in the pleural membranes, opening ventrally, are the spiracles of the first segment. These are larger than those of the other abdominal segments. The sternum consists of a curved, lightly chitinized caudal sclerite extending for nearly the entire width of the segment, and of a membranous cephalic portion connecting with the metathorax. The chitinized portion has along its cephalic border two pointed projections which point mesad.

The tergite of the second segment consists of a simple, linear, chitinized sclerite which extends nearly the entire width of the segment. It is about one-third the length of the third tergite. The pleura are represented only by pleural membranes in which the spiracles of this segment are located. The spiracles open dorsally and appear to be in the membrane laterad of the second tergite. The sternum of segment two is a curved, chitinous piece extending the entire width of the segment.

Segments three, four, five and six have distinct and complete terga, sterna and pleura. The terga are arched and form the dorsal and lateral surfaces. The ventral surface is formed by the pleura, which are subrectangular and longer than wide, and by the sterna, which are also subrectangular, but wider than long. Each pleuron bears a spiracle in a cephalomesal position. The fourth segment is slightly longer than the third, and the fifth and sixth are about the same length and longer than the fourth.

Segment seven is also complete. The tergum and pleura are the same as in the preceding segments. The sternum forms the subgenital plate and is commonly called the last ventral segment. Its lateral margins converge caudad and its caudal border bears a broad but shallow indentation along its mesal half. Dorsad of the sternum of segment seven is an invaginated pocket in which the bases of the valves of the ovipositor are located. Its ventral side is formed by the apical portion of the seventh sternum and a membrane arising from the dorsal surface of this sclerite and extending cephalad to its base. The dorsal side of the pocket is formed by a membrane which is continuous with the membrane of the ventral side, and which extends caudad to the eighth sterna with which it connects. The greater part of this dorsal membrane is strongly chitinized, but medially it is apparently divided by a narrow, clear line which expands apically into the entirely membranous apex connecting with

the eighth sterna. Laterally this pocket is bounded by the continuation of the dorsal membrane to the seventh and eighth pleura. The anterior portions of these lateral membranes are strongly chitinized and curve mesad ventrally.

The terminal segments of the female abdomen bear the external organs of reproduction and are modified for this purpose. Segment eight is represented externally only by the tergum and the pleura. The tergum is essentially the same as in the preceding segments, but narrows slightly caudad. The pleura narrow caudad and are triangular in shape. They include the ventral cephalic portion of the ninth segment between them and bear the last pair of spiracles. Externally segment nine consists only of a tergum, commonly called the pygofer, which almost completely encircles the abdomen, leaving only a ventral groove in which the ovipositor is folded. Ventrally it extends cephalad, ending in two obtuse points between the eighth pleurites. The caudal portion encircles nearly the whole segment and tapers towards its caudal end.

The anal tube is composed of segments ten and eleven. Segment ten arises from the narrowed apex of segment nine and is short and tubular. It connects by a distinct intersegmental membrane with segment eleven, which is also tubular and can be telescoped within segment ten. Segment eleven bears the telson, the extreme apical portion of the abdomen. Along the dorsal edge of the telson is the anus, an opening running for its entire length and guarded by hairs.

There are eight spiracles in the abdomen of the female located in the first eight segments as described.

Along the ventral side of the abdomen there occur many short, fine hairs, which in all cases point backward. The hairs on the ninth segment, or pygofer, are somewhat longer than those on the other parts of the abdomen.

THE OVIPOSITOR.

(Pl. XXI, figs. 4-9.)

This description was made from the ovipositor of *Oncometopia lateralis* (Fabricius). However, in the many other species of leaf hoppers examined, the fundamental structure of the ovipositor was found to be the same as for the species here described.

The ovipositor of the leaf hopper is fitted for sawing slits in plant tissues and for placing eggs within these slits. When not in use it lies in the groove in the ventral surface of the ninth segment. The ovipositor consists of three pairs of valves or gonapophyses. The

inner two pairs alone function in sawing slits and placing eggs, and the outer pair act as guards within which the two inner pairs lie when not in use. In this discussion the valves are numbered I, II and III, according to their attachment, the most cephalic in attachment being numbered I.

Valve I is the outer and more ventral of the two inner pairs of valves. Its chief attachment is to the eighth sternum, which is divided and appears as two subrectangular, heavily chitinized sclerites, for the most part hidden in the pocket above the seventh sternum. Near its base, a narrow, curved rod leaves its dorsal margin and attaches basally to a small, triangular sclerite on the dorsal side of the cephalic end of the pygofer. This small triangular sclerite is possibly the ninth pleurite. Upon attempting to separate the narrow, rodlike portion from the rest of the valve, a featherlike structure, consisting of a middle portion formed by the continuation of the attaching rod and membranous side plates, can be drawn out. However, except basally, this featherlike structure is entirely incorporated into the main part of the valve, both structurally and functionally. The main part of the valve is relatively broad basally, narrows slightly beyond the base, broadens again towards the middle, and narrows to a sharp, apical point. A heavily chitinized rod strengthens the ventral portion of this valve. The rod is comparatively large basally, narrows in the middle portion, and is absent in the apical third. Along the entire dorsal border and along the ventral apical border are diagonal rows of scalelike processes. Along its mesal surface, just dorsad of the chitinized rod, is a mushroom-shaped groove into which a complementary tongue on the outer surface of valve II fits. This permits independent sliding of the two valves, but not complete separation. Basally the ventral edges of this valve turn mesad, and on the dorsal side of this inturned portion is a less heavily chitinized projection. This projection in the one valve bears a tongue, and in the other a groove, uniting the two basally. For the greater part of their length, however, they are independent.

Valve II is the inner and the more dorsal of the two inner pairs of valves. It is attached to the cephalic end of a small sclerite, which is attached to the pygofer. This sclerite is ventral in position and possibly represents the ninth sternite. This valve is narrow and rodlike at the base, but for its greater length is broad and flat. It also possesses a chitinized strengthening rod which extends nearly to its apex. On the outer surface of the valve, just ventrad of the rod, is a tongue which fits into the groove in valve I. The dorsal

edge usually bears teeth, which may extend for its entire length, be confined to the apical half, or appear only at the tip. The teeth are of various shapes in the different species, and may or may not in turn bear secondary teeth. The pointed tip is usually notched with small teeth, and these may appear on either the dorsal or ventral or both sides. From the interior of the valve certain ductlike structures lead to the dorsal and apical teeth. The function of these ducts is unknown. This pair of valves is usually united one to the other basally, sometimes by a heavy chitinized connection, sometimes only by a membrane, but not by a tongue and groove.

Valve III is the most caudal in attachment, being attached to the caudal end of the same sclerite to which valve II is attached. There is also a membranous connection between this valve and the ventral side of the pygofer for about half the length of the valve. The proximal half of the valve is narrow and the apical half broad and spoonlike, being somewhat concave on its inner surface. It is bluntly rounded at the apex. This pair of valves, between which there is no connection, forms a protecting sheath in which the ovipositor is completely encased when not in use.

Oviposition of *Cicadella hieroglyphica* (Say) has been observed and the use of the ovipositor noted. Valve III remains in its position in the groove of segment nine and takes no part in the operation. Valves I and II, closely appressed and appearing as a single structure, are extruded from their resting place and form the functional part of the ovipositor. The ovipositor is first held vertically and its tip inserted under the epidermis of the leaf. It is then pushed in to nearly its full length, and now is in a horizontal position, the flat surface of the ovipositor being parallel with the flat surface of the leaf. The teeth on the dorsal edge of the ovipositor are now turned cephalad. The ovipositor is pushed backward and forward with a sawlike motion until the chamber is large enough for the reception of the egg. The egg passes out between the valves of the ovipositor and into the chamber, and when in place, the ovipositor is withdrawn and folded into its resting place.

TAXONOMIC USE OF THE OVIPOSITOR.

In the search for characters of taxonomic value in the ovipositor, valve II was at once hit upon as being the structure most likely to possess useful characters. It varies in different species in regard to size, shape, number and shape of primary teeth, number and shape of the secondary teeth borne by the primary teeth, characters of the tip, and in the number and arrangement of the ducts. That these

characters are constant within the species has been proven by examining a wide range of individuals within the species and finding that the variation was negligible. Consequently, for the taxonomic part of this paper, valve II is used exclusively.

The technique used in mounting valve II for study is simple. The tip of the abdomen bearing the ovipositor is broken off from the dried specimen, soaked in ten per cent caustic potash for twenty-four hours, washed in water for a few minutes, valve II and other desired parts dissected out under a binocular microscope, dehydrated in ninety-five per cent alcohol for five minutes, cleared in xylol for five minutes, and mounted in balsam on a microscope slide. It is well to give the slide and the specimen from which the slide was made a corresponding number, so that any necessary checks may be made. This method gives a permanent mount, which may be studied at the convenience of the worker.

Several methods of figuring the ovipositor were used. The first was that of drawing the desired valve free-hand with the aid of a micrometer eyepiece divided into squares, which correspond to squares on the drawing paper. This is a satisfactory method, but somewhat more laborious than the methods later used. The second was to draw with the aid of the camera lucida. The particular equipment available did not give satisfactory results at all times, but there is no doubt but what this method could be used with satisfaction. The greatest degree of success was obtained by the use of the Edinger drawing apparatus. This apparatus projects the desired image upon the drawing paper, and the figuring consists only of tracing in the image. Photography was tried and found to be a very successful means of reproducing the desired image. A camera fitted for ordinary scientific work was used. It was turned to a vertical position and a lens board fitted with a black, light-proof sleeve was inserted in the front lens-board holder. The sleeve was lowered over the ocular of a compound microscope, and focusing for desired size and definition of image accomplished by a combination of microscope and camera adjustments. Various substitutions in objectives and oculars were necessary to meet all conditions. Illumination was furnished by an ordinary substage light, and exposures were made by the switching off and on of this lamp. Undoubtedly much better results could be obtained with the aid of special photomicrographic equipment.

Descriptions of the ovipositors of the genera and species of the various subfamilies follow:

SUBFAMILY BYTHOSOPINÆ (Dohrn).

Agalliopsis novella (Say).

(Pl. XXII, fig. 2.; pl. XXV, fig. 1.)

Length, 1.1 mm.; greatest width, 0.11 mm. Apical toothed half only slightly wider than basal half; distinctly curved, tip rather gradually narrowed, extreme apex somewhat pointed, chitinization light; strengthening rod extends caudad as far as twenty-first or twenty-second dorsal tooth from apex. Toothed area on dorsal edge occupies slightly less than the apical half, teeth sixty-three to sixty-five in number, very small, angular, pointed, rather regular in size, shape and spacing; a few double teeth present, no secondary teeth; the tip is notched on both edges with small teeth, practically continuous around the tip, twenty to twenty-two on ventral edge; area of ducts inconspicuous, a few ducts faintly visible for their entire length, but for the most part are invisible except for their apices and circular openings, open along the ventral apical edge (seven), along the dorsal edge of the toothed area, and in the basal region; the two valves of the pair are joined one to the other by a narrow, elongate, chitinized connection present on the dorsal edge of the basal region at a point about two-fifths the length.

Aceratagallia uhleri (Van Duzee).

(Pl. XXV, fig. 2.)

Length, 1 mm.; greatest width, .07 mm. Apical half very little if any wider than basal half; distinctly curved, tip gradually narrowed, extreme apex rather pointed, chitinization moderately light; strengthening rod extends caudad as far as twenty-second dorsal tooth from apex. Toothed area on dorsal edge occupies the apical half of the length; teeth about ninety in number, very small, angular, pointed, fairly regular as to size, shape and spacing, larger apically; bear no secondary teeth; the tip is notched with small teeth on both edges, continuous around the tip, about twenty-two on the ventral edge; area of ducts conspicuous, ducts easily visible for entire length; open along ventral apical edge (five to six), along dorsal edge of toothed area, and in basal region; the two valves of the pair are joined one to the other by an elongate, narrow, chitinized connection present on the dorsal edge at a point about one-third the length.

This ovipositor is similar to that of *Agalliopsis novella* (Say) in general appearance.

Genus IDIOCERUS Lewis.

The ovipositors of seven species of this genus have been examined and found to be generally similar. In each case the ovipositor is about the same width for the entire length and is only slightly curved. Examples of light, medium and heavy chitinization are found. The valve may be toothed along its dorsal edge from a fourth to a little more than a half its length apically. The teeth in the specimens examined are ten to thirty in number, medium to large in size, rounded, evenly spaced, and may or may not bear secondary teeth. The ducts may appear ductlike, granular, or be

invisible. The apex may or may not bear small teeth along one or both edges. A chitinous connection is present on the dorsal edge of the basal area in some species.

Idiocerus nervatus Van Duzee.

(Pl. XXV, fig. 9.)

Length, 1.4 mm.; greatest width, 0.12 mm. Apical portion slightly wider than basal portion; slightly curved, tip greatly narrowed with the extreme apex bluntly rounded, very lightly chitinized; strengthening rod extends caudad as far as eleventh dorsal tooth. Toothed area on dorsal edge occupies the apical two-fifths of the length; teeth fourteen to sixteen in number, large, long, rounded, regular, evenly spaced, though somewhat farther apart basally; bear no secondary teeth, though the margin is irregularly roughened; the tip is notched on both edges with small, forward-pointing teeth, eight appear ventrally, one to three dorsally; area of ducts inconspicuous, circular openings alone visible; of these four open ventrally, three apically, and many dorsally. There is no evidence of a chitinous connection.

Idiocerus pallidus Fitch.

(Pl. XXII, fig. 1; pl. XXV, fig. 5.)

Length, 2.4 mm.; greatest width, 0.25 mm. About the same width for entire length; slightly curved, tip bluntly rounded, heavily chitinized; strengthening rod extends caudad as far as ninth dorsal tooth. Toothed area on dorsal edge occupies a little more than the apical third; teeth fourteen in number, large, rounded, regular, evenly spaced except basally, where they are farther apart; secondary teeth only on last eight primary teeth, these very small and indistinct, especially on those farthest from the tip, where they can be seen only with the aid of high-power magnification; the tip is notched with small, regular teeth on both dorsal and ventral edges; area of ducts conspicuous, ducts elongate, large, straight; six open along ventral apical edge, one in extreme apex, and many along the dorsal edge. A rather indistinct chitinous connection is present on the dorsal edge of the basal area and joins the two valves of the pair.

Idiocerus duzeei Provancher.

(Pl. XXV, fig. 6.)

Length, 2.6 mm.; greatest width, 0.34 mm. Apical portion slightly wider than basal portion; slightly curved, tip ends in somewhat rounded, obtuse point, heavily chitinized; strengthening rod extends caudad as far as sixth dorsal tooth. Toothed area on dorsal edge occupies a little less than the apical half, teeth nine to ten in number, large, somewhat angular, regular, evenly spaced, but larger and farther apart basally, teeth one and two being very large, rounded, and heavily chitinized; all the primary teeth except teeth one, two and three are notched with small secondary teeth; tip is notched with many small, regular teeth on both dorsal and ventral edges; ducts conspicuous, rather small, straight, open by circular openings; six open along the ventral apical edge, one in extreme apex, and many along the dorsal edge; there is no well-defined chitinized connection between the two valves of the pair.

Idiocerus verticis (Say).

(Pl. XXV, fig. 7.)

Length, 1.55 mm.; greatest width, 0.15 mm. Apical portion only slightly wider than basal; slightly curved, tip greatly narrowed with extreme apex rounded, chitinization light; strengthening rod extends caudad as far as fourteenth dorsal tooth. Toothed area on dorsal edge occupies a little more than the apical third; teeth twenty in number, large, rounded, regular, evenly spaced except basally; bear no distinct secondary teeth, though the margin is irregularly roughened suggesting secondary teeth; the tip bears ten small caudad-pointing teeth along its ventral edge; the ducts are inconspicuous, their circular openings alone being visible; of these apparently two open ventrally, three apically, and many dorsally; there is no distinct chitinized connection between the two valves of the pair.

Idiocerus scurra (Germar).

(Pl. XXV, fig. 8.)

Length, 2.22 mm.; greatest width, 0.28 mm. About the same width for entire length; slightly curved, tip narrowed but broadly rounded at the extreme apex, rather heavily chitinized; strengthening rod extends caudad as far as the twenty-fifth dorsal tooth. Toothed area on dorsal edge occupies a little more than the apical half; teeth thirty in number, moderately large, rounded, regular, evenly spaced, about the same distance apart for entire length; bear no secondary teeth; the ventral edge of the tip bears ten small teeth; area of ducts conspicuous, granular in appearance, circular openings visible; two open ventrally, two apically, and many dorsally; the two valves of the pair are joined one to the other by a distinct, elongate, chitinized connection present on the dorsal edge of the basal area.

Idiocerus ramentosus (Uhler).

(Pl. XXV, fig. 4.)

Length, 1.96 mm.; greatest width, 0.17 mm. About the same width for entire length; only slightly curved, tip greatly narrowed with extreme apex rounded, moderately heavy chitinization; strengthening rod extends caudad as far as eleventh dorsal tooth. Toothed area on dorsal edge occupies a little more than the apical third; teeth eighteen in number, large, rounded, generally regular with a few double teeth, evenly spaced but farther apart basally; bear no secondary teeth; the tip bears three to four small, inconspicuous teeth along its ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; two to three open ventrally, three apically, and many dorsally; the two halves of the pair joined one to the other by an elongate, narrow, chitinized connection present on the dorsal edge of the basal area.

Idiocerus snowi Gillette and Baker.

(Pl. XXV, fig. 3.)

Length, 2.33 mm.; greatest width, 0.22 mm. About the same width for entire length; slightly curved, tip very bluntly rounded, rather heavily chitinized; strengthening rod extends caudad as far as eighth dorsal tooth. Toothed area on dorsal edge occupies the apical fourth; teeth ten in number,

medium in size, broad and rounded, regularly spaced except basally, where they are farther apart; bear no secondary teeth; no teeth present at the apex, area of ducts conspicuous, granular in appearance, circular duct openings visible, none open ventrally, six apically, and many dorsally; the two valves of the pair are joined one to the other by an elongate, narrow, chitinized connection present on the dorsal edge of the basal area.

Genus MACROPSIS Lewis.

The ovipositors of two species of this genus have been examined and found to be very similar. They are long, narrow and rodlike, about the same width for entire length, slightly curved, and narrow only at the apex to an obtuse point. The two valves of the pair are not identical as to length, shape of tip, and teeth found at tip. The toothed area occupies only a small part of the length at the apex. The teeth are few in number, rather large, rounded, and may or may not bear secondary teeth. The tip is notched with small teeth in both species. The ducts are elongate, conspicuous, few in number, and located only apically.

Macropsis viridis (Fitch).

(Pl. XXVI, fig. 1.)

Length, 2.3 mm.; greatest width, 0.05 mm. Very long, narrow, rodlike, about the same width for entire length, the two valves of the pair are not identical in length, shape of tip, and teeth found at tip; slightly curved, narrows at apex to obtuse point, rather heavily chitinized, strengthening rod extends caudad as far as second dorsal tooth. Toothed area occupies but a small portion at the apex, the longer valve bears two large teeth on its dorsal edge and eleven small, inconspicuous teeth along its ventral edge, the shorter valve bears three large teeth along its dorsal edge and eleven small teeth along its ventral edge, none of these teeth bear secondary teeth; the extreme apex of the longer valve is entirely devoid of teeth, while the ventral teeth of the shorter valve extend to the apex, ducts are conspicuous, few in number, elongate, all opening apically, two to four openings visible.

Macropsis suturalis (Osborn and Ball).

(Pl. XXVI, fig. 2.)

Length, 2.1 mm.; greatest width, 0.05 mm. Very long, narrow, rodlike, about the same width for entire length; the two valves of the pair are not identical, but differ in length, shape of tip, and teeth at tip; slightly curved, narrows at tip to an obtuse point, chitinization moderately heavy, somewhat lighter than in *M. viridis;* strengthening rod extends caudad as far as fifth dorsal tooth. Toothed area includes only the apical portion; the longer valve bears on its dorsal edge two large, heavily chitinized teeth at the tip and three large, somewhat less heavily chitinized teeth back from the tip; on its ventral edge are seventeen small teeth which are continuous around the tip; the shorter valve bears three large, heavily chitinized teeth at the tip, three less heavily chitinized teeth back from the tip, both groups being

on the dorsal edge, and thirteen small teeth on the ventral and apical edges; the three large teeth at the apex of the shorter valve bear small secondary teeth; the ducts are conspicuous, few in number, all located at the apex, six to seven openings visible.

Oncopsis distinctus (Van Duzee).

(Pl. XXVI, fig. 3.)

Length, 1.5 mm.; greatest width, 0.08 mm. Long, narrow, rodlike, about the same width for entire length; the two valves of the pair are not identical, but differ in length, shape of tip, and teeth found at tip; slightly curved, narrow at apex to obtuse point, heavily chitinized; strengthening rod extends caudad as far as the second dorsal tooth. Toothed area on dorsal edge occupies only the apical portion of the valve; the longer valve bears two large, heavily chitinized teeth on the dorsal edge and fourteen small, inconspicuous teeth on the ventral edge, and the shorter valve bears two large, heavily chitinized teeth on the dorsal edge and fourteen small, inconspicuous teeth on its ventral and apical edges; none of the teeth bear secondary teeth; the ducts are conspicuous, elongate, few in number; five to six open apically, and others are scattered along the basal rod of the valve and open dorsally.

Genus BYTHOSCOPUS Germar.

The ovipositors of two species of this genus have been examined and found to be similar. They are about the same width for the entire length; slightly though distinctly curved, narrow abrutly near the apex, and end in a rounded extreme apex. The teeth on the dorsal edge occupy about a third of the apical length, are numerous, small, irregular, and bear no secondary teeth. There are teeth on the ventral edge of tip in both species. The ducts are conspicuous, elongate, rather few in number. In both species there is present on the dorsal edge about midway of the valve an elongate, distinct, heavily chitinized connection between the two valves of the pair.

Bythoscopus apicalis (Osborn and Ball).

(Pl. XXV, fig. 10.)

Length, 1.53 mm.; greatest width, 0.14 mm. The apical portion is slightly wider than the basal portion, distinctly curved; the valve narrows from a point about six-sevenths of its entire length to the tip, extreme apex rounded, chitinization moderately heavy; strengthening rod extends caudad to within six dorsal teeth from the apex. Toothed area on the dorsal edge occupies a little more than the apical third of the length; teeth numerous, very small and inconspicuous, flatly rounded, irregular in shape and size, unevenly spaced; bear no secondary teeth; the ventral edge of the tip bears a few inconspicuous teeth; ducts conspicuous, comparatively few in number, one group opens apically, and another group along the basal rod of the valve about midway; the two valves of the pair are joined one to the other by a distinct, elongate, chitinized connection present on the dorsal edge about midway of the valve, this connection bearing an angular tooth near its caudal extremity.

Bythoscopus miscellus (Stal).

(Pl. XXV, fig. 11.)

Length, 1.27 mm.; greatest width, 0.08 mm. About the same width for entire length; distinctly curved, tip narrowed abruptly from a slight prominence on the dorsal edge about eight-ninths of the length to a broadly rounded extreme apex; chitinization medium heavy, somewhat lighter than in *B. apicalis;* strengthening rod extends caudad as far as fourteenth dorsal tooth from the apex. Toothed area on dorsal edge occupies a little less than the apical third; teeth numerous, small, rather sharply pointed, irregular, unevenly spaced; bear no secondary teeth; the tip is notched with teeth which are continuous around the tip, ten to eleven on the ventral edge; ducts conspicuous, elongate, few in number; one group opens apically, another at the basal end of the toothed area, and another in the basal rod about midway; the two valves of the pair are joined one to the other by a distinct, elongate, chitinized connection present on the dorsal edge about midway.

SUBFAMILY CICADELLINÆ Van Duzee.

Genus ONCOMETOPIA Stal.

The ovipositors of two species of this genus have been examined and found to be similar, though having some very distinct differences. The ovipositor of *O. undata* more closely resembles the ovipositor of *Homalodisca triquetra* than it does the ovipositor of *O. lateralis*. In the ovipositors of this genus we find a narrow, curved, rodlike basal attachment, and a broad, flat, apical shaft bearing teeth along its dorsal edge, and a preapical prominence on its ventral edge. The primary teeth in each case bear secondary teeth. The tip is notched with small teeth on both edges; the ducts are conspicuous, elongate, numerous, and distinctly curved.

Oncometopia undata (Fabricius).

(Pl. XXII, fig. 3; pl. XXVI, fig. 4.)

Length of toothed area, 1.8 mm.; greatest width, 0.27 mm. Narrow and rodlike at base, widens beyond base into flat, broad apical shaft, which is about the same width for entire length and tapers only at the apex; preapical prominence present, conspicuous, broadly rounded; apical shaft slightly curved, tip broadly rounded, chitinization medium; strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies entire length of broadened shaft; teeth thirty-one to thirty-two in number, of medium size, of a general triangular shape with the caudal side much longer than the cephalic side; apices rounded, regular, evenly spaced, more heavily chitinized than the rest of the valve; possess secondary teeth on both caudal and cephalic edges, one to four on cephalic edge and two to five on caudal edge, those on the caudal edge much larger than those on the cephalic edge; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, fifteen teeth present on ventral edge between preapical

prominence and extreme apex; ducts conspicuous, decidedly curved, numerous, most numerous apically; open apically and along dorsal edge in and near teeth, one to three to each tooth.

Oncometopia lateralis (Fabricius).

(Pl. XXII, fig. 4; pl. XXVI, fig. 5.)

Length 1.66 mm.; greatest width, 0.2 mm. Narrow and rodlike at the base, widens beyond base into broad, flat apical shaft, which tapers very slightly toward apex; preapical prominence present, rather indistinct, broadly rounded; only very slightly curved beyond the base, tip broadly rounded, chitinization medium, strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies the entire length of the apical shaft; teeth eighteen to twenty in number, large, subquadrate in shape with the cephalic side longer than the caudal and bearing a smoothly rounded prominence, regular, evenly spaced, more heavily chitinized than the rest of the valve and have the appearance of being set into the rest of the valve; bear secondary teeth, seven to fifteen on the broad outer edge and four to eight on the cephalic side, those on the outer edge larger than those on the cephalic side; the tip is notched with small teeth on both dorsal and ventral edges, not continuous around the tip, twenty-one teeth between preapical prominence and extreme apex; ducts conspicuous, elongate, distinctly curved, numerous, most numerous apically; open apically, along the dorsal edge in and near teeth, two to four to each tooth; first three teeth not served with ducts.

Homalodisca triquetra (Fabricus).

(Pl. XXII, fig. 5; pl. XXVI, fig. 6.)

Length, 2.6 mm.; greatest width, 0.33 mm. Narrow and rodlike at base, widens beyond base into broad, flat portion, which is about the same width for entire length, narrowing only at apex; preapical prominence present, distinct, broadly rounded; uncurved beyond base, extreme apex broadly rounded, chitinization medium; strengthening rod extends caudad as far as third dorsal tooth from the apex. Toothed area on dorsal edge occupies the entire length of the apical shaft; teeth forty-four to forty-five in number, medium in size, of a general triangular shape with the caudal side longer than the cephalic, regular in size and shape, evenly spaced, more heavily chitinized than the rest of the valve; bear secondary teeth, three to seven on the cephalic edge and five to nine on the caudal edge; those on the caudal edge are larger than those on the cephalic edge; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, ducts conspicuous, numerous, slightly curved, most numerous apically; open apically along the dorsal edge in and near teeth, two to five to each tooth; the first six teeth not served by ducts.

Aulacizes irrorata (Fabricius).

(Pl. XXII, fig. 6; pl. XXVI, fig. 7.)

Length, 2.9 mm.; greatest width, 0.44 mm. Narrow and rodlike at the base, widens beyond base into broad, flat, apical shaft; reaches point of greatest width about two-fifths of length and from that point tapers gradually to the tip; preapical prominence present, conspicuous, obtuse-angled; not curved

beyond curved basal attachment; tip bluntly rounded, chitinization medium; strengthening rod extends caudad as far as third dorsal tooth from apex. Toothed area on dorsal edge occupies the entire length of the apical shaft; teeth forty-one to forty-three in number, rather small, in the shape of a flattened isosceles triangle, regular in size and shape, evenly spaced; the first twelve teeth bear no secondary teeth; the teeth caudad of the first twelve teeth bear four to ten secondary teeth on the caudal side; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip; thirty-five to thirty-seven teeth on ventral edge between preapical prominence and extreme apex; ducts conspicuous, elongate, rather narrow, curving, numerous, most numerous apically; open apically, along dorsal edge, near but not in teeth, and in face of valve back from edge; the first twelve teeth are not served by ducts.

Genus CICADELLA Latreille.

The ovipositors of two species of this genus have been examined and found to be similar. In each case the ovipositor consists of a narrow, curved basal attachment and a wider apical shaft which bears teeth along its dorsal edge, in turn bearing secondary teeth. A preapical prominence is present in one species, absent in the other. The tip is notched on both dorsal and ventral edges. The ducts are rather inconspicuous, elongate, rather few in number, and distinctly curved.

Cicadella hieroglyphica (Say).

(Pl. XXII, fig. 7; pl. XXVI, fig. 9.)

Length, 1.66 mm.; greatest width, 0.13 mm. Curved basal attachment narrow and rodlike; apical portion consists of a broad, flat shaft, about the same width for entire length, tapering only at apex, preapical prominence present on the ventral edge, obtuse-angled; only slightly curved; apex greatly narrowed and acutely pointed, very lightly chitinized; strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies the entire length of the apical shaft; teeth seventeen to eighteen in number, medium in size, somewhat triangular with the apex flattened and the caudal side slightly longer than the cephalic, regular in size and shape, evenly spaced, more heavily chitinized than the rest of the valve; bear a large number of small, irregular, secondary teeth on both edges; tip notched with small teeth on both edges; a large number of very small teeth occur between the tip of the preapical prominence and the extreme apex; ducts rather inconspicuous, few in number greatly curved; open apically, along dorsal edge in and near teeth, and a few in the face of the valve back from the edge.

Cicadella circellata (Baker).

(Pl. XXII, fig. 8; pl. XXVI, fig 8.)

Length, 1.6 mm.; greatest width, 0.09 mm. Apical, flattened portion only slightly wider than basal portion; preapical prominence wanting; only slightly curved, tip greatly narrowed but rounded at extreme apex, chitinization rather light but heavier than in *C. hieroglyphica*; strengthening rod extends caudad as far as and beyond last dorsal tooth. Toothed area on dorsal edge

occupies nearly all of broadened area or about half the total length; teeth thirteen in number, rather small, in the general shape of a greatly flattened obtuse triangle with the caudal side much longer than the cephalic, regular in spacing; bear secondary teeth on both edges, five to eight on caudal edge and one to two on cephalic edge, those on the caudal edge are much the larger; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, twenty present on ventral edge; ducts rather inconspicuous, though more conspicuous than in *C. hieroglyphica*, elongate, few in number, distinctly curved; open apically, along dorsal edge in and near teeth, and in face of valve back from edge.

Genus KOLLA Distant.

The ovipositors of three species of this genus have been examined and found to be similar. In each case the ovipositor consists of a curved, narrow, rodlike basal attachment and a broader, flat, apical shaft bearing teeth along its dorsal edge. The teeth are triangular in shape and bear small secondary teeth along their caudal sides. The tip is notched in each case with small teeth present on both edges, but not continuous around the tip. The ducts may or may not be visible; when visible they are elongate, rather straight, and few in number.

Kolla bifida (Say).

(Pl. XXII, fig. 13; pl. XXVIII, fig. 3.)

Length, 1.5 mm.; greatest width, 0.22 mm. Basal connection narrow and rodlike; apical shaft broad, flat, narrowing gradually to the apex; no preapical prominence; only very slightly curved beyond curved basal attachment; apex narrowed with extreme apex rounded, only lightly chitinized; strengthening rod extends caudad as far as and beyond last apical tooth. Toothed area on dorsal edge occupies entire length of apical shaft and more than two-thirds of the entire length; teeth fourteen in number, medium in size, in the general shape of a greatly flattened obtuse triangle with the caudal edge much longer than the cephalic and the apex rounded, not distinctly more heavily chitinized than the rest of the valve; bear small secondary teeth along the caudal edge only, seven to twenty-one on each tooth; the tip is notched with small teeth on both dorsal and ventral edges, not continuous around the tip, fourteen to fifteen on ventral edge; ducts inconspicuous, only apices and circular openings visible; open apically, along the dorsal edge in and near teeth, and a few in the face of the valve back from the edge.

Kolla geometrica (Signoret).

(Pl. XXVIII, fig. 2.)

Length, 1.17 mm.; greatest width, 0.17 mm. Basal portion narrow and rodlike; apical shaft broad, flat, tapers to apex; no preapical prominence; not curved beyond base; tip greatly narrowed with extreme apex rounded bluntly; chitinization light though somewhat heavier than in *K. bifida;* strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies entire length of broadened shaft; teeth seventeen to nineteen in

number, rather small, in the general shape of a greatly flattened obtuse triangle with the caudal side much longer than the cephalic and the apex rounded, rather irregular in size and spacing, slightly more heavily chitinized than the rest of the valve; bear secondary teeth along the caudal edge only, four to fourteen on each tooth; tip notched with teeth on both dorsal and ventral edges, not continuous around the tip, thirteen to fifteen on ventral edge; ducts easily visible for entire length, comparatively few in number, straight, more numerous apically; open apically, along dorsal edge in and near teeth, and in the face of valve back from edge.

Kolla hartii (Ball).

(Pl. XXII, fig. 14; pl. XXVIII, fig. 1.)

Length, 1.4 mm.; greatest width, 0.22 mm. Basal portion narrow and rod-like; apical shaft broad and flat, tapers towards apex; no preapical prominence; not curved beyond base, tip greatly narrowed, extreme apex smoothly rounded, lightly chitinized; strengthening rod extends caudad beyond last dorsal tooth. Toothed area on dorsal edge occupies entire length of apical shaft; teeth seventeen in number, medium in size, in the shape of an obtuse triangle, though not so flat as in *K. bifida* and *K. geometrica;* caudal edge somewhat longer than cephalic edge, rather irregular in size and spacing, not more heavily chitinized than the rest of the valve; possess small secondary teeth on the caudal edge of each primary tooth, eight to seventeen to each tooth; tip notched with small teeth on both dorsal and ventral edges, not continuous around tip, twenty-three on ventral edge; ducts more conspicuous than in *K. bifida,* less conspicuous than in *K. geometrica;* bases and apices visible but middle portions invisible; open apically, along dorsal edge in and near teeth, and in face of valve back from edge.

Helochara communis Fitch.

(Pl. XXII, fig. 10; pl. XXVII, fig. 5.)

Length, 1.44 mm.; greatest width, 0.22 mm. Basal portion narrow and curved, apical shaft broad and flat, about the same width for entire length, tapers toward tip; bears no preapical prominence; not curved beyond the base, tip greatly narrowed, with the extreme apex ending in an obtuse point, chitinization medium; strengthening rod extends caudad to a point midway between the last dorsal tooth and the tip. Toothed area on dorsal edge occupies the entire length of the apical shaft, nearly the entire length of the valve; teeth thirty in number, rather large, the first fourteen of a general triangular shape, apical sixteen subquadrate with the cephalic side longer than the caudal, rather irregular in size, shape, and spacing; basal fourteen primary teeth bear small secondary teeth on the two exposed sides of the triangle; apical sixteen primary teeth also bear secondary teeth on the outer margin, three to fourteen in number; tip is notched with small teeth on both dorsal and ventral edges, not continuous around the tip, forty-six present on ventral edge; ducts conspicuous, rather numerous, elongate, rather straight, occupy entire shaft; open apically, along dorsal edge in and near teeth, and in face of valve back from edge.

Graphocephala coccinea (Forster).

(Pl. XXII, fig. 9; pl. XXVIII, fig. 4.)

Length, 1.87 mm.; greatest width, 0.22 mm. Basal portion narrow and rodlike, apical shaft broad and flat, about the same width for entire length; preapical prominence present, distinct, obtuse-angled; not curved beyond base, tip greatly narrowed and ending in a rather blunt point, chitinization light; strengthening rod extends caudad beyond last dorsal tooth. Toothed area on dorsal edge occupies entire length of apical shaft; teeth nineteen in number, medium in size, of a general triangular shape with the caudal side longer than the cephalic, regular in size and shape, distinctly more heavily chitinized than the rest of the valve; bear small secondary teeth on both edges, three to six on cephalic edge and eight to seventeen on caudal edge; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, forty-five between preapical prominence and extreme apex; ducts easily visible though not conspicuous, elongate, rather few in number, curved, most numerous apically; open apically, along dorsal edge in teeth, one to two to each tooth, and a few in the face of valve back from edge.

Genus DRÆCULACEPHALA Ball.

The ovipositors of three species of this genus have been examined and found to be similar. The ovipositor of *Helochara communis* also shows its close relationship to this genus. In each case the ovipositor consists of a curved, rodlike basal attachment and a broad, flat, apical shaft which bears teeth along its dorsal edge for the entire length. The distal teeth are triangular and the apical teeth subquadrate. Both types of teeth bear small secondary teeth. The tip in every case is notched with small teeth on both dorsal and ventral edges, not continuous around the tip. The ducts may or may not be conspicuous, but where visible are elongate, numerous and curved.

Dræculacephala mollipes (Say).

(Pl. XXII, fig. 11; pl. XXVII, fig. 2.)

Length, 2.1 mm.; greatest width, 0.33 mm. Basal portion narrow and rodlike, apical shaft broad and flat, about the same width for entire length, narrowing caudad to apex; preapical prominence wanting; not curved beyond base, tip greatly narrowed by curving ventral edge and ends in an obtuse point, chitinization moderately heavy; strengthening rod extends caudad to a point midway between last dorsal tooth and apex. Toothed area on dorsal edge occupies entire length on apical shaft; teeth twenty-eight in number, large, basal nine of a general triangular shape, apical nineteen subquadrate with the cephalic side longer than the caudal, rather irregular in size, shape and spacing; the basal nine bear small secondary teeth on both cephalic and caudal edges; the apical subquadrate teeth also bear secondary teeth, seven to seventeen on the outer edge and all except the apical five bear secondary teeth along the cephalic edge, one to six in number; tip is notched with small teeth on both dorsal and ventral edges, not continuous around the tip, forty-

two on the ventral edge; ducts conspicuous, rather numerous, elongate, slightly curved, most numerous apically; open apically, along dorsal edge in and near teeth, and in the surface of the valve back from edge.

Dræculacephala noveboracensis (Fitch).

(Pl. XXVII, fig. 1.)

Length, 2.65 mm.; greatest width, 0.33 mm. Narrow and rodlike at base, broad and flat apically, apical shaft about the same width for entire length; preapical prominence wanting; only slightly curved beyond base, tip greatly narrowed by slightly curving dorsal edge and greatly curving ventral edge and ends in a rather sharp point, chitinization light, much lighter than in the other members of this genus examined; strengthening rod extends caudad to a point midway between last dorsal tooth and apex. Toothed area on dorsal edge occupies entire length of apical shaft, the dorsal edge bearing the teeth more heavily chitinized than the rest of the valve; teeth thirty-nine to forty-one in number, of medium size, the basal sixteen of a general triangular shape, the apical twenty-three subquadrate with the cephalic side longer than the caudal, rather irregular in size, shape, and spacing; the basal triangular teeth bear small secondary teeth on both dorsal and ventral edges; the apical subquadrate teeth bear three to twelve secondary teeth on the outer edge and two to five on the cephalic edge; the secondary teeth midway of the valve are very small and indistinct; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, forty-five present on the ventral edge; ducts inconspicuous, very faintly visible except at openings, rather numerous, most numerous apically; open apically, along dorsal edge in and near teeth, and in surface of valve back from edge.

Dræculacephala reticulata (Signoret).

(Pl. XXII, fig. 12; pl. XXVII, fig. 3.)

Length, 1.75 mm.; greatest width, 0.27 mm. Basal portion narrow and rodlike, apical portion broad, flat, about the same width for entire length, narrows at apex; preapical prominence wanting; not curved beyond curved basal attachment, tip greatly narrowed by slightly curved dorsal edge and greatly curved ventral edge, ends in obtuse point, chitinization medium, less heavy than in *D. noveboracensis* and heavier than in *D. mollipes;* strengthening rod extends caudad to a point midway between last dorsal tooth and apex. Toothed area on dorsal edge occupies apical shaft for entire length; teeth twenty-six to twenty-eight in number, rather large, basal eleven of a general triangular shape, apical fifteen subquadrate with the cephalic side longer than the caudal, rather irregular in size, shape and spacing; basal eleven bear small secondary teeth on both edges; apical subquadrate teeth also bear secondary teeth, three to eleven on the outer edge and, with the exception of the apical three, one to five on the cephalic edge; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, 42 present on the ventral edge; ducts conspicuous, rather straight, numerous, most numerous apically; open apically, along dorsal edge in and near teeth, and a few in the face of valve back from edge.

Pagaronia tripunctata (Fitch).

(Pl. XXVII, fig. 6.)

Length, 1.5 mm.; greatest width, 0.17 mm. Narrow and rodlike at base, apical shaft broad and flat, about the same width for entire length, narrows caudad to apex; preapical prominence wanting; not curved beyond base, tip narrowed, bluntly rounded at extreme apex, chitinization light; strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies entire length of apical shaft, dorsal edge bearing teeth is more heavily chitinized than the rest of the valve; teeth seventeen to twenty in number, medium in size, in the shape of a flattened obtuse triangle with the caudal side much longer than the cephalic, irregular in size, shape and spacing; bear secondary teeth on both outer edges, three to ten on cephalic edge and three to twenty-five on the caudal edge; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, 30 present on ventral edge; ducts conspicuous, rather numerous, only slightly curved, most numerous apically; open apically, along dorsal edge in and near teeth, and a few in the surface of valve back from edge.

Errhomenellus montanus Baker.

(Pl. XXVII, fig. 4.)

Length, 2.83 mm.; greatest width, 0.22 mm. About the same width for entire length; preapical prominence present, rather indistinct, broadly rounded; only slightly curved beyond curved basal attachment, tip greatly narrowed with the extreme apex rounded, chitinization medium; strengthening rod extends caudad as far as fourth dorsal tooth. Toothed area on dorsal edge occupies less than a fourth of the entire length apically; teeth seven to eight in number, small, inconspicuous, rounded, regular in size and shape, rather far apart, uneven in spacing, bear no secondary teeth; tip bears no teeth; no distinct ducts visible, circular openings plainly visible, of these a number occur on the ventral apical edge, some at the extreme apex, and also along the entire dorsal edge.

SUBFAMILY GYPONINÆ (Stal).

Genus GYPONA Germar.

The ovipositors of four species of this genus have been examined and found to be similar. The ovipositor of *Xerophlœa viridis*, the only other species of this subfamily examined, is not similar to the ovipositors of the genus Gypona. In this genus the ovipositor is relatively short, stout and broad, usually being rather heavily chitinized. The apical portion is not much, if any, wider than the basal portion. Teeth are present along the dorsal edge for from one-fourth to one-half the apical length. The tip may or may not bear teeth on one or both edges. The ducts in every case are conspicuous, large, elongate and numerous.

Gypona octo-lineata (Say).

(Pl. XXIII, fig. 1; pl. XXVIII, fig. 8.)

Length, 2 mm.; greatest width, 0.48 mm. Consists of a rather narrow basal portion, which widens out into a broad, apical portion, which narrows caudad to the apex, point of greatest width about midway; no preapical prominence; slightly curved, tip greatly narrowed with the extreme apex broadly rounded, chitinization moderately heavy; strengthening rod extends caudad almost to apex. Toothed area on dorsal edge occupies about a half of the apical length; teeth numerous, rather small, rounded, irregular in size, shape and spacing; bear no secondary teeth; tip bears small teeth on both dorsal and ventral edges, not continuous around the tip, thirteen on ventral edge; ducts conspicuous, large, numerous, apparently arising from a common cavity in the center of the valve, most numerous at the tip; open along ventral apical edge, at extreme apex, and along the dorsal edge for the entire length, though very few in basal region.

Gypona bimaculata Spangberg.

(Pl. XXVIII, fig. 5.)

Length, 3.17 mm.; greatest width, 0.42 mm. About the same width for entire length, bears a broadly rounded, heavily chitinized prominence on the dorsal edge somewhat less than midway of the length, tapers caudad toward apex; slightly curved, tip gradually narrowed, ending in a blunt point, chitinization heavy, much heavier than in *G. octo-lineata;* strengthening rod extends caudad almost to apex. Toothed area on dorsal edge occupies about one-third of apical length; teeth numerous, rather small, rounding, irregular in size and shape; bear no secondary teeth; tip notched on dorsal edge and at extreme apex with small teeth, none present on ventral edge; ducts conspicuous, very large, rather straight; open apically and along dorsal and ventral edges for the length of the toothed area, a few also open in the basal region.

Gypona angulata Spangberg.

(Pl. XXVIII, fig. 6.)

Length, 1.75 mm.; greatest width, 0.35 mm. Apical portion somewhat wider than basal, point of greatest width about midway, tapers caudad to apex; only slightly curved, tip gradually narrowed with the extreme apex rounded, chitinization moderately heavy; strengthening rod extends caudad to within a short distance of tip. Toothed area extends from the prominence on the dorsal edge to the apex; teeth numerous, small and indistinct, rather flatly rounded, very irregular in size, shape and spacing; bear no secondary teeth; no teeth on tip; ducts conspicuous, large, numerous, broadly curving, most numerous apically; open apically, along ventral apical edge, along dorsal edge of toothed area, and a few in the basal portion of the valve.

Gypona pectoralis Spangberg.

(Pl. XXVIII, fig. 7.)

Length, 1.83 mm.; greatest width, 0.42 mm. Very broad and heavy for entire length, point of greatest width about midway, where there is a broadly rounded prominence on the dorsal edge, narrows caudad to apex; slightly curved, tip greatly narrowed with extreme apex rounded, chitinization very

heavy; strengthening rod extends caudad almost to apex. Toothed area on dorsal edge occupies about a fourth of the apical length; teeth very few in number, small, flat, somewhat rounded, very irregular in size, shape and spacing, bear no secondary teeth; no teeth present at extreme apex; ducts conspicuous, large, somewhat branching, more numerous apically; open apically, along ventral apical edge, and along dorsal for entire length.

Xerophlœa viridis (Fabricius).

(Pl. XXIII, fig. 2; Pl. XXIX, fig. 2.)

Length, 2.88 mm.; greatest width, 0.08 mm. Narrow and rodlike, about the same width for entire length; distinctly curved, tip bluntly rounded, chitinization medium; strengthening rod extends caudad as far as twentieth dorsal tooth. Toothed area on dorsal edge occupies a little less than the apical third; teeth twenty-four in number, medium in size, rounded, regular in size and shape, the apical four are farther apart than the basal twenty; the apical three bear one to three secondary teeth on the caudal edge; tip notched with small teeth on both dorsal and ventral edge, not continuous around the tip, twelve to thirteen on ventral edge; ducts conspicuous, relatively few in number, most numerous at apex; open apically and along entire dorsal edge, even in basal portion.

SUBFAMILY JASSINÆ (Amyot and Serville).

TRIBE ACUCEPHALINI (Dohrn).

Stroggylocephalus agrestis (Fallen).

(Pl. XXIX, fig. 3.)

Length, 1.88 mm.; greatest width, 0.17 mm. Curved base rather narrow and rodlike, rather broad and flat beyond base, about the same width for entire length, tapers gradually toward apex; curved at base of broadened area, tip greatly narrowed with extreme apex narrowly rounded, chitinization rather light, strengthening rod extends caudad as far as sixth dorsal tooth from apex. Toothed area on dorsal edge occupies a little less than half the entire length, teeth twenty-six to twenty-eight in number, rather small, of a general triangular shape, some rounded and some sharply pointed, very irregular in size, shape and spacing; bear no secondary teeth; tip notched with a few small, indistinct, irregular teeth on the ventral edge only; ducts conspicuous, elongate; open along ventral apical edge, at extreme apex, and along entire dorsal edge; the two valves of the pair are joined one to the other by a distinct, elongate, heavily chitinized connection present on the dorsal edge near the base of the broadened area.

Memnonia consobrina Ball.

(Pl. XXIX, fig. 5.)

Length, 2.2 mm.; greatest width, 0.25 mm. Curved basal attachment narrow and rodlike, beyond base is a rather narrow, lightly chitinized area extending caudad for about a third of the length; caudad of this is a broader, more heavily chitinized portion occupying the rest of the valve; narrows rather abruptly caudad to apex; only slightly curved beyond base, tip greatly narrowed by broadly curving dorsal edge; extreme apex ends in sharp, acute-

angled point, chitinization moderately light; strengthening rod extends caudad almost to apex. There are no evidences of distinct teeth, though the margin is irregularly roughened in several places; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge, at extreme apex, and along dorsal edge for entire length.

Xestocephalus pulicarius Van Duzee.

(Pl. XXIII, fig. 3; pl. XXIX, fig. 1.)

Length, 0.88 mm.; greatest width, 0.08 mm. Curved basal attachment narrow and rodlike, rest of valve about the same width for entire length; preapical prominence on ventral edge present, distinct, obtuse angled, giving the apical portion of the valve the appearance of a spear head; tip narrowed abruptly beyond preapical prominence; very distinctly, broadly and evenly curved; tip greatly narrowed, ending in sharply pointed extreme apex, chitinization medium; strengthening rod extends caudad to within a short distance of extreme apex; dorsal edge of tip bears an indistinct notch where rod meets dorsal edge. Toothed area on dorsal edge occupies the apical three-fourths of the length; teeth fourteen to fifteen in number, small, indistinct, rather irregular in size, shape and spacing, especially basally; bear no secondary teeth; tip bears no teeth; ducts rather inconspicuous though plainly visible, rather few; open in preapical prominence, at extreme apex, and along entire dorsal edge; the two valves of the pair are joined one to the other by a distinct, elongate, narrow, heavily chitinized connection present on the dorsal edge, this connection more liberally supplied with ducts than the portion of the valve immediately caudad of it.

TRIBE JASSINI (Dohrn).

Dorycephalus platyrhynchus Osborn.

(Pl. XXIX, fig. 4.)

Length, 3.5 mm.; greatest width, 0.5 mm. Curved basal portion narrow and rodlike; at a point about a third of the length it widens into a broad, flat shaft which tapers slightly caudad; point of greatest width is a little less then midway; only slightly curved beyond base, tip greatly narrowed by rounding dorsal edge, extreme apex rounded, chitinization very light; strengthening rod extends caudad to within a short distance of the extreme apex. There are no distinct teeth, though the ventral apical edge and the entire dorsal edge are slightly and irregularly roughened; area of ducts inconspicuous, no ducts visible, circular duct openings visible; a single row opens along the ventral apical edge, a single row along the dorsal apical edge, distad of these a double row, distad of the double row a triple row, and still further distad in the wider portion of the valve as many as four or five irregular rows open in the entire breadth of the valve.

Hecalus lineatus (Uhler).

(Pl. XXIX, fig. 8.)

Lenth, 4.1 mm.; greatest width, 0.43 mm. Curved basal portion narrow and rodlike, widens beyond base into broad, flat portion which tapers gradually caudad to apex, point of greatest width about two-fifths of length; only slightly curved beyond base, tip greatly narrowed, ending in sharp point, chitinization

moderately light; strengthening rod extends caudad to within a short distance of the apex. No distinct teeth present, the ventral apical edge and the entire dorsal edge except at the apex are slightly and irregularly roughened; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge and along dorsal edge for entire length, in the basal region they open irregularly in the entire width of the valve.

Spangbergiella mexicana Baker.

(Pl. XXIX, fig. 6.)

Length, 1.9 mm., greatest width, 0.27 mm. Curved base narrow and rodlike, widens into broad, flat portion, about the same width for entire length, narrowing caudad to apex; bears two prominences, one on dorsal edge somewhat less than midway, and the other on the ventral edge about two-thirds the length, more angular; not curved beyond the base, narrowed at tip evenly and gradually by both curving edges, ends in sharp point, chitinization medium; strengthening rod extends caudad almost to apex. Bears no teeth; area of ducts granular in appearance, circular openings very small and inconspicuous; open along ventral apical edge, at extreme apex, along dorsal edge, and in basal portion of valve.

Parabolocratus flavidus Signoret.

(Pl. XXIX, fig. 7.)

Length, 2.3 mm.; greatest width, 0.27 mm. Curved base narrow and rodlike, widens gradually into broad, flat portion, about the same width for entire length, narrowing only at apex; bears two broadly rounded prominences, one on the dorsal edge about a third of the length, the other on the ventral edge about two-thirds the length; only slightly curved beyond base, tip gradually narrowed and ends in sharp point, chitinization medium; strengthening rod extends caudad to within a short distance of the apex. Toothed only at extreme tip; teeth are continuous around the tip, of these six are on the dorsal edge and ten on the ventral edge; ducts inconspicuous, invisible except at extreme apices, circular openings visible; open along ventral apical edge and along entire dorsal edge except in dorsal prominence.

Aligia jucunda (Uhler).

(Pl. XXIX, fig. 11.)

Length, 1.83 mm.; greatest width, 0.17 mm. Curved base narrow and rodlike, slightly wider beyond base for a little more than half the length; apical portion of valve widens abruptly, tapers caudad to apex; distinctly curved, tip narrowed by curved dorsal edge, extreme apex bluntly rounded, almost square, chitinization medium; strengthening rod extends caudad to within fourteen dorsal teeth of apex. Toothed area on dorsal edge occupies somewhat less than the apical half; teeth eighty-eight in number, very small, wedge-shaped, fairly regular in size, shape and spacing, bear small secondary teeth on outer edge, one to four in number; tip devoid of teeth on ventral and caudal edges; area of ducts conspicuous, granular in appearance, though a few elongate ducts are visible apically; ducts straight, numerous; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal region. The two valves of the pair are joined one to the other by an elongate

connection only slightly more heavily chitinized than the rest of the valve, present on the dorsal edge in the basal region.

Genus MESAMIA Ball.

Two species of this genus have been examined and found to be similar. In each case the ovipositor consists of a curved basal attachment, a somewhat wider portion that extends about to the midpoint, and an apical portion which bears teeth along its dorsal edge. A small preapical prominence is present on one of the two species. Some of the primary teeth, at least, bear secondary teeth. In one species the tip bears distinct teeth, in the other the tip is only irregularly roughened. The area of ducts is granular in appearance and the duct openings are visible. The two valves of the pair are joined one to the other by an elongate, heavily chitinized connection present on the dorsal edge in the basal region.

Mesamia straminea (Osborn).

(Pl. XXIX, fig. 9.)

Length, 1.53 mm.; greatest width, 0.18 mm. Curved basal portion narrow and rodlike, beyond base is a wider, heavily chitinized area extending almost to the midpoint; the apical toothed area occupies the rest of the valve and is slightly wider, less heavily chitinized, and tapers caudad to the apex; bears no preapical prominence; slightly, though distinctly curved, tip narrowly rounded, chitinization moderately heavy; strengthening rod extends caudad as far as fourth dorsal tooth from the tip. Toothed area on dorsal edge occupies the apical half; about twenty-five primary teeth present, of medium size, very irregular as to size, shape and spacing; the apical ten are somewhat regular, long and flatly rounded and may or may not bear a few secondary teeth on the caudal edge, the teeth distad of these extremely irregular; the tip is irregularly roughened on both dorsal and ventral edges, but bears no distinct teeth; area of ducts granular in appearance, duct openings easily visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in the basal portion of the valve; the two valves of the pair are joined one to the other by a distinct, elongate, heavily chitinized connection present on the dorsal edge at about one-third the length; the apex is apparently strengthened by a straight, narrow rod that extends from the interior of the valve to the extreme apex, occupying about the apical sixth of the length.

Mesamia vitellina (Fitch).

(Pl. XXIII, fig. 7; pl. XXIX, fig. 10.)

Length, 1.47 mm.; greatest width, 0.13 mm. Curved basal connection narrow and rodlike, widens out into broader area, which is about the same width for entire length and toothed apically; a small preapical prominence is present on the ventral edge; distinctly curved, tip narrowed, narrowly rounded at extreme apex, chitinization moderately heavy; strengthening rod extends caudad as far as fifth dorsal tooth from apex. Toothed area on dorsal edge occupies a little less than the apical half; teeth seventeen in number, rather small, in

the general shape of a greatly flattened obtuse triangle with a rounded apex, fairly regular in size, shape and spacing, those distad being very flat and indistinct, bear small; numerous secondary teeth on both cephalic and caudal edges; tip notched with small teeth on both edges, not continuous around the tip, twelve to thirteen present between preapical prominence and apex, area of ducts granular in appearance, circular duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in basal portion of the valve; the two valves of the pair are joined one to the other by an elongate, distinct, heavily chitinized connection present on the dorsal edge at a point a little more than one-third the length of the valve; the apex is apparently strengthened by a short, narrow rod which can be seen only at the extreme apex, much shorter and lighter than in *M. straminea.*

Genus SCAPHOIDEUS Uhler.

The ovipositors of two species of this genus have been examined. They do not resemble each other to the degree that is common between two species of the same genus, though they have many points in common. In each case the ovipositor is about the same width for the entire length, narrows only at the apex, and bears no preapical prominence. The dorsal edge bears teeth along the apical two-fifths of its length, but these teeth differ in number, size, shape, and possession of secondary teeth in the two species, the tip bears teeth in one species, none in the other; the area of ducts is granular in appearance and the duct openings are visible. The two valves of the pair are joined one to the other by an elongate, heavily chitinized connection present on the dorsal edge about midway of the valve.

Scaphoideus scalaris Van Duzee.

(Pl. XXX, fig. 1.)

Length, 1.53 mm.; greatest width, 0.13 mm. Curved basal connection narrow and rodlike, rest of valve about the same width for entire length, narrowing only at apex; bears no preapical prominence; slightly curved, tip narrowed, bluntly rounded at extreme apex, chitinization rather heavy; strengthening rod extends caudad almost to second dorsal tooth from apex. Toothed area on dorsal edge occupies a little more than the apical two-fifths of the length; teeth nine in number, rather large, broadly rounded, rather irregular in size, shape and spacing being farther apart basally; bear no secondary teeth; tip bears no teeth, ducts granular in appearance, circular duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal region where elongate ducts are visible; the two valves of the pair are joined one to the other by an elongate, heavily chitinized connection present on the dorsal edge about midway of the valve; this connection occupies a little less than a third of the entire length and bears the first dorsal tooth.

Scaphoideus immistus (Say).

(Pl. XXIII, fig. 4; pl. XXX, fig. 2.)

Length, 1.77 mm.; greatest width, 0.11 mm. Narrow and rodlike at base, rest of valve somewhat broader, about the same width for entire length, narrows caudad to apex; bears no preapical prominence; distinctly curved, tip greatly narrowed, extreme apex rounded, chitinization moderately heavy; strengthening rod extends caudad as far as fifth dorsal tooth from apex. Toothed area on dorsal edge occupies a little less than the apical two-fifths of the length; teeth sixteen in number, rather small, rounded, rather irregular in size, shape and spacing being farther apart basally; may bear secondary on one or both edges, small secondary teeth also present on margin of valve between primary teeth, general arrangement of secondary teeth very irregular; tip notched with small, irregular teeth on both edges, though more distinct on the ventral edge, not continuous around the tip, eight to nine present on the ventral edge; ducts partly granular and partly elongate, circular openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal region; the two valves of the pair are joined one to the other by an elongate, heavily chitinized connection present on the dorsal edge about midway, occupies about two-fifths of length, bears one rounded tooth somewhat caudad of the center.

Genus PLATYMETOPIUS Burmeister.

The ovipositors of three members of this genus have been examined and found to be similar. In each case the basal half is slightly narrower than the apical half, which bears teeth along its dorsal edge. A preapical prominence may or may not be present. The primary teeth bear secondary teeth on both edges, more on the caudal than on the cephalic edge. In every case the tip is notched with small teeth on both dorsal and ventral edges; these may or may not be continuous around the tip. The area of ducts may or may not be conspicuous, when visible is granular in appearance with the duct openings visible. The two valves of the pair are joined one to the other by a rather short, chitinous connection present on the dorsal edge of the basal area.

Platymetopius acutus (Say).

(Pl. XXIII, fig. 5; pl. XXX, fig. 3.)

Length, 1.36 mm.; greatest width, 0.17 mm. Curved basal connection narrow and rodlike; beyond this is a somewhat wider portion extending nearly to midpoint, and apically the toothed area, about the same width for entire length, narrowing only at apex, bears an indistinct, broadly angled preapical prominence on the ventral edge; slightly though distinctly curved, tip narrowed and ending in a bluntly rounded extreme apex, chitinization light; strengthening rod extends caudad as far as fifth dorsal tooth from apex. Toothed area on dorsal edge occupies the apical half of the valve; teeth twenty-seven in number, rather large; in the greater number of teeth the basal

edges of each tooth are more or less parallel and the apical edges taper, giving a gabled appearance to the tooth; the caudal edge is somewhat longer than the cephalic, fairly regular as to size, shape and spacing, though not entirely so; primary teeth bear small secondary teeth on caudal edge more commonly, and a few teeth also bear secondary teeth on the cephalic edge; tip notched with small teeth on both dorsal and ventral edges, continuous around the tip, nineteen present on ventral edge between preapical prominence and apex; area of ducts inconspicuous, the apices and circular openings alone being visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal portion of the valve; the two valves of the pair are joined one to the other by an indistinct, chitinous connection present on the dorsal edge at about a third of the length.

Platymetopius cinereus Osborn.

(Pl. XXX, fig. 4.)

Length, 1.13 mm.; greatest width, 0.13 mm. Curved basal connection narrow and rodlike; a wider area extends almost to midpoint, a slighter wider apical portion occupies the rest of the valve; no preapical prominence; slightly curved, tip narrowed, ends in obtuse-angled point, chitinization moderately light; strengthening rod extends caudad as far as sixth dorsal tooth from apex. Toothed area on dorsal edge occupies a little more than the apical half; teeth twenty-three to twenty-four in number, moderately large, of a general triangular shape with the caudal side in most cases longer than the cephalic and with apices rounded, fairly regular in size, shape and spacing; bears small secondary teeth on caudal edge, three to eight in number, and a few of the teeth also bear a single secondary tooth on the cephalic edge; tip notched with small teeth on both dorsal and ventral edges, more numerous and distinct on ventral edge, not continuous around the tip, fourteen present on the ventral edge; ducts very inconspicuous, only a few being visible in the apex of the valve, apices of ducts and duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal portion of the valve; the two valves of the pair are joined one to the other by a poorly defined, heavily chitinized connection present on the dorsal edge at about one-third the length.

Platymetopius frontalis Van Duzee.

(Pl. XXIII, fig. 6; pl. XXX, fig. 5.)

Length, 1.26 mm.; greatest width, 0.16 mm. Curved basal connection narrow and rodlike; a slightly wider portion extends to a point nearly midway; the apical portion is slightly wider, narrows caudad to apex, bears a suggestion of a broadly rounded preapical prominence on the ventral edge; slightly curved, tip narrowed, ends in a blunt, obtuse-angled point, chitinization moderately heavy, heavier than in *P. acutus* and *P. cinereus;* strengthening rod extends caudad as far as fifth dorsal tooth from apex. Toothed area on dorsal edge occupies a little more than the apical half; teeth twenty-one to twenty-two in number, rather large; in the greater number the basal edges of each tooth are parallel and the apical edges taper to a rounded apex, fairly regular in size, shape and spacing; bear small secondary teeth for the most part on the

caudal edge; tip notched with small teeth on both dorsal and ventral edges, practically continuous around the tip, eighteen present on the ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge, along dorsal edge of toothed area, and irregularly in the basal area of the valve; the two valves of the pair are joined one to the other by a distinct, rectangular, heavily chitinized connection present on the dorsal edge at about one-third the length.

Genus DELTOCEPHALUS Burmeister.

The ovipositors of seven species of this genus have been examined and found to be similar. The ovipositor is slightly curved, gradually narrowed toward the apex, with apical half little if any wider than the basal half. The apical half bears teeth along its dorsal edge, usually small, rounded, and bearing a few secondary teeth. The apex may or may not bear small teeth on one or both edges. The area of ducts may or may not be conspicuous; when visible is granular in appearance with duct openings visible. The two valves of the pair are joined one to the other by a chitinous connection present on the dorsal edge of the basal area.

Deltocephalus reflexus Osborn and Ball.

(Pl. XXX, fig. 6.)

Length, 1.18 mm.; greatest width, 0.09 mm. About the same width for entire length; tapers gradually caudad to tip; no preapical prominence; slightly but distinctly curved, tip gradually narrowed, extreme apex sharply pointed, chitinization light; strengthening rod extends caudad as far as tenth dorsal tooth from tip, nearly meeting dorsal edge. Toothed area on dorsal edge occupies somewhat less than the apical half of the valve; teeth about forty in number, rather small, of various sizes and shapes, presenting an irregular, crenulate margin; a few of the larger teeth bear secondary teeth; the extreme tip bears no teeth; ducts inconspicuous, invisible except for apices and circular openings; open along ventral apical edge, along dorsal edge of toothed area, and irregularly in the basal portion of the valve; the two valves of the pair are joined one to the other by a poorly defined, rather elongate, heavily chitinized connection present on the dorsal edge a little past a third of the length.

Deltocephalus weedi Van Duzee.

(Pl. XXX, fig. 7.)

Length, 1.05 mm.; greatest width, 0.13 mm. Narrow and rodlike at base; a somewhat wider, rather heavily chitinized area extends almost to midpoint; the apical half is occupied by a still wider, less heavily chitinized area which tapers to apex; preapical prominence wanting; slightly curved, tip greatly narrowed, extreme apex rounded, chitinization moderately heavy; heavier than in *D. reflexus;* strengthening rod extends caudad as far as or beyond last dorsal tooth. Toothed area on dorsal edge occupies a little more than the apical half of the valve; about thirteen large primary teeth, these are comparatively

small, rounded, fairly regular in size, shape and spacing; bear a few small secondary teeth on caudal edge; margin of valve between teeth is also notched with small secondary teeth; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, nine present on ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal area where elongate ducts are visible; the two valves of the pair are joined one to the other by an elongate, distinct, heavily chitinized connection present on the dorsal edge about a third of the length.

Deltocephalus inimicus (Say).

(Pl. XXIII, fig. 8; pl. XXX, fig. 8.)

Length, 1.1 mm.; greatest width, 0.11 mm. About the same width for entire length, narrows caudad to apex, preapical prominence wanting; slightly curved; tip greatly narrowed, extreme apex rounded, chitinization moderately heavy; strengthening rod extends caudad as far as last dorsal primary tooth. Toothed area on dorsal edge occupies apical half; primary teeth thirteen in number, small, rounded, rather regular as to size, shape and spacing; bear a few small secondary teeth on caudal edge; margin of valve between primary teeth is also notched with small teeth; ventral edge of tip is notched with small teeth, dorsal edge devoid of teeth at apex, fifteen present on ventral edge; area of ducts somewhat granular, though elongate ducts are present, circular duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area and irregularly in the basal region; the two valves of the pair are joined one to the other by an elongate, distinct, heavily chitinized connection present on the dorsal edge at about one-third the length.

Deltocephalus flavicosta Stål.

(Pl. XXIII, fig. 9; pl. XXX, fig. 9.)

Length, 1 mm.; greatest width, 0.1 mm. Apical portion bearing teeth occupies a little more than one-half the length, is slightly wider than the basal portion, narrows caudad to apex; no preapical prominence; slightly curved, tip narrowed, extreme apex bluntly rounded, chitinization moderately heavy; strengthening rod extends caudad as far as last primary tooth. Toothed area on dorsal edge occupies a little more than the apical half; teeth twelve to thirteen in number, small, rounded, rather regular in size, shape and spacing; bear a few small secondary teeth along the caudal edge; margin of valve between primary teeth is also notched with small secondary teeth; tip notched with small teeth on ventral edge, dorsal edge devoid of teeth at apex, eleven present on ventral edge; area of ducts somewhat granular in appearance, though elongate ducts are visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and irregularly in the basal area; the two valves of the pair are joined one to the other by an elongate, curved, heavily chitinized connection present on the dorsal edge at about one-fourth the length.

Deltocephalus debilis Uhler.

(Pl. XXX, fig. 10.)

Length, 1.33 mm.; greatest width, 0.15 mm. About the same width for entire length beyond curved basal connection, narrows caudad to apex; preapical prominence wanting; distinctly curved, tip gradually narrowed, extreme apex rounded, chitinization moderately heavy; strengthening rod extends caudad as far as fourth dorsal tooth from apex. Toothed area on dorsal edge occupies apical two-fifths of length; primary teeth thirteen to fourteen in number, small, usually rounded, irregular as to size, shape and spacing; for the most part bear no secondary teeth, though a few irregular secondary teeth are present; the margin of the valve between the primary teeth is notched with small, irregular teeth; the tip is slightly and irregularly roughened, but bears no distinct teeth; area of ducts conspicuous, granular in appearance, though elongate ducts are visible; open along ventral apical edge (five), at extreme apex (one), along dorsal edge of toothed area, and in the basal portion of the valve; the two valves of the pair are joined one to the other by a distinct, elongate, slightly curved, heavily chitinized connection present on the dorsal edge of the basal area, occupying more than one-third the entire length.

Deltocephalus parvulus Gillette.

(Pl. XXX, fig. 11.)

Length, 0.87 mm.; greatest width, 0.08 mm. About the same width for entire length beyond curved basal connection, tapers gradually caudad to apex; preapical prominence wanting; only slightly curved, tip narrowed, ends in sharp point, chitinization light; strengthening rod extends caudad almost to last dorsal primary tooth. Toothed area on dorsal edge occupies a little less than the apical half; primary teeth nine to ten in number, very small, rounded, fairly regular in size, shape and spacing, in most cases bear a few secondary teeth; margin of valve between primary teeth also bears small, regular secondary teeth, which point forward; tip devoid of teeth; ducts inconspicuous, their apices and circular openings alone being visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in the basal area where elongate ducts are visible; the two valves of the pair are joined one to the other by an elongate, curved, distinct, heavily chitinized connection present on the dorsal edge of the basal area and occupying about one-fifth of the entire length.

Deltocephalus collinus Boheman.

(Pl. XXX, fig. 12.)

Length, 1.3 mm.; greatest width, 0.13 mm. Narrow and rodlike at base; beyond base a broader and more heavily chitinized portion extends to midpoint; apical portion is still wider, less heavily chitinized, tapers caudad apically; preapical prominence wanting; slightly curved, tip greatly narrowed, extreme apex narrowly rounded, rather blunt, chitinization moderately light; strengthening rod extends caudad as far as seventh primary tooth from apex. Toothed area on dorsal edge occupies a little less than the apical half; about seventeen primary teeth present, these are small, somewhat rounded, very irreg-

ular as to size, shape and spacing and may or may not bear a few small secondary teeth on the caudal edge; margin of valve between primary teeth notched with small, irregular teeth, especially caudad of apex; tip devoid of teeth; area of ducts conspicuous, granular in appearance, though elongate ducts are visible, circular duct openings visible; open along ventral apical edge (five), at extreme apex (one), along dorsal edge of toothed area, and irregularly in the basal area; the two valves of the pair are joined one to the other by a distinct, elongate, slightly curved, heavily chitinized connection present on the dorsal edge, occupying about one-fifth of entire length.

Aconura argentiolus (Uhler).

(Pl. XXXI, fig. 9.)

Length, 1.77 mm.; greatest width, 0.11 mm. About the same width for entire length, tapers caudad to apex; bears no preapical prominence; slightly curved, tip narrowed, rather blunt, obtuse-angled point, chitinization very light; strengthening rod extends caudad to a point between last and next to last dorsal tooth. Toothed area on the dorsal edge occupies a little more than the apical half; teeth twenty-two in number, very small, in the general shape of a greatly flattened obtuse triangle with the caudal edge longer than the cephalic, rather irregular in size, shape and spacing; bear many small, regular secondary teeth along both edges, more numerous on the caudal edge, continuous along entire dorsal margin of valve toward apex; tip notched with small regular teeth on both dorsal and ventral edges, not continuous around the tip, teeth on ventral edge slightly larger than those or dorsal; areas of ducts inconspicuous; ducts invisible except for apices and circular openings; open along ventral apical edge, in extreme apex, along dorsal edge of toothed area, and irregularly in the basal portion of the valve.

Nephotettix curtipennis (Gillette and Baker).

(Pl. XXXI, fig. 10.)

Length, 2.5 mm.; greatest width, 0.25 mm. Apical toothed half slightly wider than basal portion, tapers caudad to apex; bears an indistinct, broadly rounded preapical prominence on ventral edge; only slightly curved, tip narrowed, ends in obtuse-angled point, chitinization moderately heavy; strengthening rod extends caudad beyond last distinct primary tooth. Toothed area on dorsal edge occupies the apical half; teeth twenty-four to twenty-five in number, of medium size, in the general shape of a very flat, obtuse triangle with the caudal side longer than the cephalic, fairly regular in size, shape and spacing; bear small, regular, secondary teeth on both edges, continuous around the apex of each tooth, seven to fifteen on caudal edge and one to four on cephalic edge; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, about 55 on ventral edge, area of ducts conspicuous, granular in appearance though elongate ducts are visible, open along ventral apical edge (five), at extreme apex (one), along dorsal edge of toothed area, and a few in the basal region; the two valves of the pair are joined one to the other by an elongate, narrow, heavily chitinized connection extending the entire length on the basal area.

Driotura gammaroides (Van Duzee).

(Pl. XXIII, fig. 10; pl. XXXI, fig. 11.)

Length, 1.8 mm.; greatest width, 0.21 mm. Apical half slightly wider than basal half, tapers caudad to apex; bears only a suggestion of a preapical prominence on the ventral edge; slightly curved, tip narrowed with extreme apex narrowly rounded, chitinization moderately heavy; strengthening rod extends caudad beyond last distinct dorsal tooth. Toothed area on dorsal edge occupies the apical half; teeth twenty in number, of medium size, in the general shape of a flat, obtuse triangle with the caudal edge longer than the cephalic, rather regular in size, shape and spacing; bear small, regular secondary teeth on both edges, continuous around the apex of each tooth, seven to eighteen on caudal edge, two to seven on ventral edge; tip notched with small teeth on both dorsal and ventral edges, practically continuous around the tip though greatly reduced at extreme apex; those on ventral edge are larger and more distinct, about fifty-four present on ventral edge; area of ducts conspicuous, granular in appearance, duct openings visible; open along ventral apical edge (five), at extreme apex (one), along dorsal edge of toothed area, and irregularly in the basal area, the two valves of the pair are joined one to the other by an elongate, narrow, heavily chitinized connection present on the dorsal edge of the basal area for its entire length.

This ovipositor is very similar in general appearance to that of *Nephotettix curtipennis*.

Genus EUSCELIS Brulle.

The ovipositors of six species of this genus have been examined and a wide variety of forms found within the genus. *Euscelis exitiosus* (Uhler) and *Euscelis striolus* (Fallen), both in subgenus *Athysanus*, are not similar in any except their grosser details. *Euscelis anthracinus* (Van Duzee), in subgenus *Euscelis*, and *Euscelis comma* (Van Duzee), in subgenus *Conomellus*, are similar one to the other but not to any other species of the genus examined. *Euscelis curtesii* (Fitch) and *Euscelis bicolor* (Van Duzee), both in subgenus *Stirellus*, are very similar one to the other but not to any other species of the genus examined.

The ovipositors of the subgenus *Stirellus* are somewhat narrower in the basal half than in the apical half, which tapers to the apex and bears teeth along its dorsal edge. The teeth differ in number and in the number of secondary teeth they bear. The apex is notched with small teeth present on the ventral edge only. The area of ducts is conspicuous, granular in appearance, with the duct openings visible. The two valves of the pair are joined one to the other by an elongate, chitinized connection present on the dorsal edge of the basal area.

Euscelis exitiosus (Uhler).

(Pl. XXIII, fig. 11; pl. XXXI, fig. 1.)

Length, 2 mm.; greatest width, 0.2 mm. Apical portion, which occupies two-thirds of length, is slightly wider than basal portion, tapers caudad to apex; bears a distinct, angled, preapical prominence on ventral edge; only slightly curved beyond curved basal attachment, rather abruptly narrowed at tip, ends in sharp point, chitinization moderately heavy; strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies apical two-thirds of length; teeth thirty-four to thirty-five in number, rather small, of a general triangular shape, with the caudal edge longer than the cephalic and the apex rounded, fairly regular in size, shape and spacing; bear small secondary teeth on both edges, not continuous around the apex of each tooth, eight to eighteen on caudal edge, two to four on cephalic edge; tip notched with small, regular teeth on both dorsal and ventral edges, practically continuous around the tip, about eighty on ventral edge between preapical prominence and extreme apex; area of ducts conspicuous, granular in appearance; open along ventral apical edge, along the dorsal edge of the toothed area, one in each tooth, and a very few in the basal area; the two valves of the pair are joined one to the other by a poorly defined connection which is slightly more heavily chitinized than the rest of the basal area, upon whose dorsal edge it is located.

Euscelis striolus (Fallen).

(Pl. XXIII, fig. 12; Pl. XXXI, fig. 2.)

Length, 1.1 mm.; greatest width, 0.16 mm. Apical portion occupying two-thirds of length but little wider than basal portion, narrows caudad to tip; bears no preapical prominence; only slightly curved, tip abruptly narrowed, ends in obtuse-angled point, chitinization moderately heavy; strengthening rod extends caudad as far as second dorsal tooth from apex. Toothed area on dorsal edge occupies apical two-thirds; teeth eleven to twelve in number, rather large, of a general triangular shape with the apices broadly rounded, fairly regular in size and shape, irregular in spacing; bear secondary teeth of various sizes and shapes on both edges, three to nine on caudal edge and one to four on cephalic edge; general arrangement of secondary teeth is very irregular; tip bears a few irregular teeth on the dorsal edge only, there is a slight irregularity of the margin on the ventral apical edge; area of ducts conspicuous, granular in appearance, circular duct openings easily visible; open along ventral apical edge, in extreme apex, along dorsal edge of toothed area, and in basal region where many elongate ducts are visible; the two valves of the pair are joined one to the other by an elongate, distinct, chitinized connection present on the dorsal edge of the basal area.

Euscelis anthracinus (Van Duzee).

(Pl. XXXI, fig. 3.)

Length, 1.4 mm.; greatest width, 0.18 mm. About the same width for entire length beyond curved basal connection; preapical prominence wanting; slightly curved, tip narrowed by broadly rounded ventral edge, extreme apex bluntly rounded, chitinization rather heavy; strengthening rod extends caudad as far as last dorsal tooth. Toothed area on dorsal edge occupies apical half;

teeth nine to ten in number, very small, rounded, fairly regular as to size, shape and spacing, being farther apart basally; bear a few small secondary teeth on caudal edge, margin of valve between teeth also notched with small, numerous secondary teeth; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, about fifteen present on the ventral edge; area of ducts conspicuous, granular in appearance, though elongate ducts are visible; duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in basal region, where many elongate ducts are visible; the two valves of the pair are joined one to the other by a distinct, elongate, curved, heavily chitinized connection present on the dorsal edge of the basal area; this connection bears a rounded prominence toward the caudal end.

Euscelis comma (Van Duzee).

(Pl. XXIII, fig. 13; pl. XXXI, fig. 4.)

Length, 1.5 mm.; greatest width, 0.22 mm. About the same width for entire length beyond curved basal connection, tapers caudad to apex; no preapical prominence; only slightly curved, tip narrowed by broadly curving ventral edge, extreme apex narrowly rounded, chitinization rather heavy; strengthening rod extends caudad to within a short distance of apex. Toothed area on dorsal edge occupies a little less than the apical half; teeth numerous, small, rounded, very irregular as to size, shape and spacing and present an irregularly crenulate margin; tip bears no distinct teeth but is irregularly roughened; area of ducts conspicuous, granular in appearance, with many elongate ducts visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in the basal region where many elongate ducts are visible; the two valves of the pair are joined one to the other by an elongate, distinct, heavily chitinized connection present on the dorsal edge of the basal area; it is a little less than half the entire length and at the point of greatest width is about one-half the width of the valve; bears an indistinct, broadly rounded prominence a little caudad of the midpoint.

Euscelis curtisii (Fitch).

(Pl. XXXI, fig. 5.)

Length, 1.1 mm.; greatest width, 0.12 mm. Apical half slightly wider than basal half, bears no preapical prominence; only slightly curved beyond curved basal attachment, gradually narrowed, ends in narrowly rounded extreme apex, chitinization moderately light; strengthening rod extends caudad as far as next to last dorsal tooth. Toothed area on dorsal edge occupies the apical half; teeth fourteen to sixteen in number, small, rounded, fairly regular in size, shape and spacing, though not entirely so; bear a few secondary teeth on the caudal edge and an occasional secondary tooth on the cephalic edge; tip notched with small teeth on ventral edge only, dorsal edge devoid of teeth at extreme apex, ten present on ventral edge; area of ducts conspicuous, granular in appearance, openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in basal region where elongate ducts are visible; the two valves of the pair are joined one to the other by a distinct, elongate, slightly curved, chitinized connection present on the dorsal edge of the basal area.

Euscelis bicolor (Van Duzee).

(Pl. XXXI, fig. 6; pl. XXIII, fig. 14.)

Length, 0.92 mm.; greatest width, 0.11 mm. Apical portion slightly wider than basal portion, tapers caudad to apex; no preapical prominence; distinctly curved, tip gradually narrowed, ends in narrowly rounded extreme apex, chitinization rather light; strengthening rod extends caudad as far as next to last dorsal tooth. Toothed area on dorsal edge occupies apical two-fifths of length; teeth twelve to thirteen in number, small, rounded, fairly regular in size, shape and spacing; bear a few small secondary teeth on caudal edge, margin of valve also notched with small secondary teeth; tip notched with small teeth on ventral edge only, eight to ten in number; area of ducts conspicuous, granular in appearance, duct openings visible; open along ventral apical edge, at extreme apex, along dorsal edge of toothed area, and in basal region, where elongate ducts are visible; the two valves of the pair are joined one to the other by an elongate connection only slightly more heavily chitinized than the rest of the basal area, occupying about one-sixth of the entire length.

Genus EUTETTIX Van Duzee.

The ovipositors of two species of this genus have been examined and found to be generally similar, though possessing many differences. In each case the basal half is somewhat narrower than the apical half, which narrows toward the apex and bears teeth along its dorsal edge. The teeth vary in number, size, shape, and possession of secondary teeth in the two species. The tip is notched with small teeth on one or both edges. The area of ducts is conspicuous, granular in appearance, with the duct openings visible. The two valves of the pair are joined one to the other by a chitinous connection present on the dorsal edge of the basal area.

Eutettix cinctus Osborn and Ball.

(Pl. XXIV, fig. 1; pl. XXXI, fig. 8.)

Length, 1.5 mm.; greatest width, 0.17 mm. Apical portion but slightly wider than basal portion, narrowed caudad toward apex; no preapical prominence; distinctly curved, tip narrowed, extreme apex broadly rounded, chitinization moderately heavy; strengthening rod extends caudad as far as fourth dorsal tooth from apex. Toothed area on dorsal edge occupies apical half of valve; teeth fourteen in number, of medium size, rounded, fairly regular in size, shape and spacing; bear secondary teeth, one to four on caudal edge; cephalic edge may also bear a single secondary tooth; margin of valve is notched with small secondary teeth between primary teeth; a few faintly visible teeth are present on the ventral edge of the tip, the dorsal edge is devoid of teeth at the extreme apex, about nine present on the ventral edge; area of ducts conspicuous, granular in appearance, duct openings easily visible; open along ventral apical edge (seventeen to nineteen), at extreme apex (three), along dorsal edge of toothed area, and in the basal region where elongate ducts are visible; the

two valves of the pair are joined one to the other by a distinct, elongate, curved, heavily chitinized connection present on the dorsal edge of the basal area; bears a distinct, rounded prominence about midway.

Eutettix strobi (Fitch).

(Pl. XXIV, fig. 2; pl. XXXI, fig. 7.)

Length, 1.3 mm.; greatest width, 0.17 mm. Apical portion somewhat wider than basal portion, narrows caudad to apex; preapical prominence wanting; slightly curved, tip narrowed by curving dorsal edge, ends in broadly rounded extreme apex, chitinization medium; strengthening rod extends caudad as far as fifth dorsal tooth from apex. Toothed area on dorsal edge occupies a little more than the apical half; teeth twenty-one to twenty-four in number, large, somewhat irregularly rounded with the caudal edge longer and more gently sloping than the cephalic edge; bear small secondary teeth on both edges, three to seven on caudal edge and one to three on cephalic edge; tip is notched with small teeth on both dorsal and ventral edges, not continuous around the tip, fifteen to nineteen on ventral edge; area of ducts conspicuous, granular in appearance, duct openings easily visible; open along ventral apical edge (fourteen), at extreme apex (one), along dorsal edge of toothed area, and in basal region where elongate ducts are visible; the two valves of the pair are joined one to the other by a rather short, distinct, heavily chitinized connection present on the dorsal edge in the basal region.

Genus PHLEPSIUS Fieber.

The ovipositors of three species of this genus have been examined and found to be generally similar. The ovipositor in each case is about the same width for entire length and tapers caudad to the apex. The toothed area on the dorsal edge occupies from a third to a half the apical length. The primary teeth vary in number, size, shape and number of secondary teeth in the various species. The tip is notched with small teeth on both edges in every case. The area of ducts is conspicuous, granular in appearance, with some elongate ducts visible and with duct openings visible; the two valves of the pair are joined one to the other by an elongate, chitinized connection present on the dorsal edge of the basal area.

Phlepsius spatulatus Van Duzee.

(Pl. XXIV, fig. 3; pl. XXXII, fig. 10.)

Length, 1.9 mm.; greatest width, 0.25 mm. About the same width for entire length, tapers caudad to apex; bears a suggestion of a preapical prominence on the ventral edge; slightly curved, narrowed by curving ventral edge, rather bluntly rounded at extreme apex, chitinization heavy; strengthening rod extends cauded as far as fifth dorsal tooth. Toothed area on dorsal edge occupies apical two-fifths; teeth fifteen to eighteen in number, of medium size, rounded, rather irregular as to size, shape and spacing; bear a few irregular secondary teeth on the caudal edge; cephalic edge of some teeth

also bears a single secondary tooth; margin of valve between primary teeth notched with small secondary teeth; tip notched with small, irregular teeth on both edges; area of ducts conspicuous, granular in dorsal region, duct-like in ventral region, circular duct openings visible; open at ventral apical edge (seven), at extreme apex (one), along dorsal edge of toothed area, and in basal region; the two valves of the pair are joined one to the other by a distinct, elongate, heavily chitinized connection present on the dorsal edge of the basal area and occupying about one-third the length.

Phlepsius excultus (Uhler).

(Pl. XXIV, fig. 4; pl. XXXII, fig. 9.)

Length, 1.8 mm.; greatest width, 0.17 mm. About the same width for entire length, tapers caudad to apex; bears a suggestion of a preapical prominence in the ventral edge, extreme apex rounded, chitinization moderately heavy; strengthening rod extends caudad as far as fourth dorsal tooth from apex. Toothed area on dorsal edge occupies a little more than the apical third of the length; teeth fifteen to seventeen in number, rather small, rounded, fairly regular in size and shape but uneven in spacing; bear a few secondary teeth on caudal edge, and a few primary teeth bear a single secondary tooth on the cephalic edge, margin of valve between primary teeth bears small secondary teeth; tip notched with small teeth on both dorsal and ventral edges, practically continuous around the tip; eight large teeth on ventral edge; these may be simple or may bear secondary teeth, irregular as to arrangement; area of ducts conspicuous, ducts elongate for the most part though a granular area is present dorsally, duct openings visible; open along ventral apical edge (six), at extreme apex (one), along dorsal edge of toothed area, and in the basal region; the two valves of the pair are joined one to the other by a distinct, elongate heavily chitinized connection present on the dorsal edge of the basal area, occupying more than a third of the total length, this connection irregularly roughened along its dorsal edge.

Phlepsius irroratus (Say).

(Pl. XXIV, fig. 5; pl. XXXII, fig. 8.)

Length, 1.5 mm.; greatest width, 0.17 mm. About the same width for entire length beyond curved basal attachment, narrows caudad to apex; preapical prominence wanting; slightly curved, tip gradually narrowed, narrowly rounded at extreme apex, chitinization moderately light; strengthening rod extends caudad as far as second dorsal tooth from apex. Toothed area on dorsal edge occupies a little less than the apical half; teeth nineteen to twenty in number, of medium size, in the general shape of an obtuse triangle with caudal edge longer than the cephalic and the apex rounded broadly, fairly regular as to size shape and spacing, but not entirely so; bear a few secondary teeth on caudal edge and also a few bear a single secondary tooth on the cephalic edge; tip is notched with small, indistinct teeth on both dorsal and ventral edge, not continuous around the tip, about fifteen on ventral edge; area of ducts conspicuous, granular in appearance, duct openings easily visible; open along ventral apical edge (ten), at extreme apex (one), along dorsal edge of toothed area, and in the basal region where elongate ducts are

visible; the two valves of the pair are joined one to the other by a heavily chitinized connection present on the dorsal edge of the basal area, occupying about a fourth of the entire length and a half of the width.

Genus ACINOPTERUS Van Duzee.

The ovipositors of three species of this genus have been examined and found to be very similar. In each case the ovipositor is greatly curved, the basal portion only slightly narrower than the apical portion, which bears teeth along its dorsal edge. The primary teeth are few in number, and differ in number and in the number of secondary teeth they bear in the various species. The margin of the valve between the primary teeth is notched with small teeth. The tip in each case is notched with small teeth on both dorsal and ventral edges. The area of ducts may or may not be conspicuous, when visible granular in appearance with duct openings visible. The two valves of the pair are joined one to the other by an elongate, curved, chitinous connection present on the dorsal edge of the basal area.

Acinopterus acuminatus Van Duzee.

(Pl. XXIV, fig. 6; pl. XXXII, fig. 3.)

Length, 1.5 mm.; greatest width, 0.12 mm. Apical portion only slightly wider than basal portion, tapers slightly caudad; bears a small preapical prominence on the ventral edge; greatly curved, chitinization moderately light; strengthening rod extends caudad as far as last or next to last dorsal tooth of large size. Toothed area on dorsal edge occupies somewhat less than the apical half; primary teeth seven in number, small, rounded, regular as to size and shape, unevenly spaced; bears three to four small secondary teeth on the caudal edge, margin of valve between primary teeth bears numerous small, regular, secondary teeth; tip notched with small teeth on both dorsal and ventral edges, not continuous around the tip, about fifteen present on the ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge (seven), at extreme apex (two), along dorsal edge of toothed area, and in the basal region; the two valves of the pair are joined one to the other by a distinct, curved, heavily chitinized connection present on the dorsal edge of the basal area.

Acinopterus viridis Ball.

(Pl. XXXII, fig. 1.)

Length, 1.7 mm.; greatest width, 0.16 mm. Apical portion only slightly wider than basal portion, narrowed caudad at apex, bears no preapical prominence; greatly curved, tip narrowed, ends in rounded extreme apex, chitinization light; strengthening rod extends caudad almost to apex. Toothed area on dorsal edge occupies the apical third; only two primary teeth present, these located near the base of the toothed area, small, rounded, bear two to three small secondary teeth on their caudal edges; the margin of the valve is notched with many small, regular secondary teeth; tip is notched on both

edges with small teeth, continuous around the tip, about ten on ventral edge; area of ducts inconspicuous, ducts invisible except for circular openings; open along ventral apical edge (six), at extreme apex (one), along dorsal edge of toothed area, and in basal area; the two valves of the pair are joined one to the other by a poorly defined, elongate connection present on the dorsal edge of the basal area, only slightly more heavily chitinized than the rest of the basal area.

Acinopterus angulatus Lawson.

(Pl. XXXII, fig. 2.)

Length, 1.2 mm.; greatest width, 0.12 mm. Apical portion only slightly wider than basal portion, narrows slightly caudad at apex; no distinct preapical prominence present; greatly curved, tip narrowed, extreme apex rounded, chitinization moderately heavy, heavier than in *A. acuminatus* and *A. viridis;* strengthening rod extends caudad as far as next to last primary tooth. Toothed area on dorsal edge occupies a little more than the apical third; teeth eight in number, small, rounded, regular in size and shape, somewhat unevenly spaced; bear secondary teeth on caudal edge, three to four in number; the margin of valve between primary teeth is notched with small, numerous, regular, secondary teeth; tip notched with small teeth on both dorsal and ventral edges, practically continuous around the tip, about fifteen on ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge (five to six), at extreme apex (one), along dorsal edge of toothed area, and in basal region; the two valves of the pair are joined one to the other by a distinct, elongate, heavily chitinized connection present on the dorsal edge of the basal area.

Genus THAMNOTETTIX Zetterstedt.

The ovipositors of two species of this genus have been examined and found to be generally similar. In each case the basal half is distinctly narrower than the apical half, which narrows caudad at the apex and bears teeth along its dorsal edge. The primary teeth differ in number, shape, and number of secondary teeth they bear in the two species. The tip is notched with small teeth on both edges. The area of ducts is conspicuous, granular in appearance, with the duct openings visible. The two valves of the pair are joined one to the other by a heavily chitinized connection present on the dorsal edge of the basal area.

Thamnotettix clitellarius (Say).

(Pl. XXXII, fig. 5.)

Length, 1.4 mm.; greatest width, 0.18 mm. Apical portion plainly wider than basal portion, narrows caudad toward apex; bears a very small preapical prominence on ventral edge; slightly curved, tip narrowed, extreme apex broadly rounded, chitinization medium; strengthening rod extends caudad as far as fourth dorsal tooth from apex. Toothed area on dorsal edge occupies a little more than the apical half; teeth twenty to twenty-three in number, of

medium size, of a general triangular shape, with the caudal edge longer than the cephalic and the apex rounded broadly, fairly regular as to size, shape, and spacing, though not entirely so; bear small secondary teeth on caudal edge and a few also bear a single secondary tooth on the cephalic edge; tip notched with small teeth on both edges, not continuous around the tip, those on ventral edge larger and more distinct, about fourteen present on ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; present along ventral apical edge (twelve), at extreme apex (one), along dorsal edge of toothed area, and in basal region where elongate ducts are visible; the two valves of the pair are joined one to the other by a distinct, heavily chitinized, rather short, rectangular connection present on the dorsal edge of the basal area.

Thamnotettix longulus Gillette and Baker.

(Pl. XXXII, fig. 4.)

Length, 1.3 mm.; greatest width, 0.17 mm. Apical portion distinctly wider than basal portion, tapers caudad at apex; no preapical prominence; slightly curved, tip narrowed, extreme apex narrowly rounded, chitinization medium; strengthening rod extends caudad as far as sixth dorsal tooth from apex. Toothed area on dorsal edge occupies somewhat more than apical half; thirty-one primary teeth present, in the general shape of an obtuse triangle, of medium size, fairly regular as to size and shape but not entirely so, uneven in spacing; bear small secondary teeth on both edges, four to twelve on caudal edge and one to four on cephalic edge, secondary teeth continuous around the apex of each tooth; tip notched with small teeth on both dorsal and ventral edge, not continuous around the apex, eight on ventral edge; area of ducts conspicuous, granular in appearance, duct openings visible; open along ventral apical edge (eight), at extreme apex (one), along dorsal edge of toothed area (about one to each tooth), and in the basal area; the two valves of the pair are joined one to the other by a distinct, elongate, heavily chitinized connection present on the dorsal edge of the basal area, occupies less than a fifth of the entire length.

Genus CHLOROTETTIX Van Duzee.

The ovipositors of two species of this genus have been examined and found to be generally similar. The basal third may or may not be narrower than the apical two-thirds, which tapers to the apex and bears teeth along its dorsal edge. The primary teeth differ in number, shape, and number of secondary teeth in the two species. The tip is notched on both edges with small teeth, not continuous around the tip. The area of ducts is granular in appearance and the duct openings are visible. The two valves of the pair are joined one to the other by a chitinous connection present on the dorsal edge of the basal area.

Chlorotettix spatulatus Osborn and Ball.

(Pl. XXIV, fig. 7; pl. XXXII, fig. 6.)

Length, 1.5 mm.; greatest width, 0.24 mm. Apical portion much wider than basal portion, tapers caudad at apex; preapical prominence wanting; slightly curved, tip rather abruptly narrowed, extreme apex narrowly rounded, chitinization medium; strengthening rod extends caudad as far as last primary tooth. Toothed area on dorsal edge occupies the apical two-thirds; teeth twenty-seven to twenty-eight in number, of medium size, rather irregular as to shape, some rounded, some triangular and some flat across the top; bear two to seven secondary teeth on the caudal edge and may or may not bear one to three secondary teeth on the cephalic edge; tip notched with small teeth on both edges, not continuous around the tip, nine to ten on ventral edge; area of ducts conspicuous, granular in appearance though many elongate ducts are visible, duct openings visible; open along ventral apical edge (eight), at extreme apex (one), along dorsal edge of toothed area, and in basal area; the two valves of the pair are joined one to the other by an elongate, rectangular, chitinized connection present on the dorsal edge of the basal area, only slightly more heavily chitinized than the rest of the valve, occupying about one-sixth of entire length.

Chlorotettix galbanatus Van Duzee.

(Pl. XXIV, fig. 8; Pl. XXXII, fig. 7.)

Length, 1.4 mm.; greatest width, 0.21 mm. About the same width for entire length, apical portion very slightly narrower than basal portion, tapers caudad to apex; no preapical prominence; slightly curved, tip gradually narrowed, extreme apex bluntly rounded, chitinization medium; strengthening rod extends caudad as far as third dorsal tooth from tip. Toothed area on dorsal edge occupies somewhat less than the apical two-thirds; teeth twenty-eight in number, of medium size, some rounded, others of a general triangular shape, evenly spaced; bear secondary teeth, two to eight on caudal edge and an occasional single secondary tooth on the cephalic edge; tip notched with small teeth on both edges, not continuous around the tip, ten present on ventral edge; area of ducts conspicuous, granular in appearance, circular duct openings visible; open along ventral apical edge (thirteen), at extreme apex (one), along dorsal edge of toothed area, and in the basal region, where elongate ducts are visible; the two valves of the pair are joined one to the other by a distinct, curved, heavily chitinized connection present on the dorsal edge of the basal area, occupying a little less than a fourth of the entire length.

Jassus olitorius Say.

(Pl. XXXIII, fig. 2.)

Length, 3.7 mm.; greatest width, 0.2 mm. Very long, narrow and rodlike, apical portion which bears teeth only slightly if any wider than basal rod, tapers only at apex; no distinct preapical prominence present; distinctly curved, tip narrowed, rounded at extreme apex, chitinization moderately heavy; strengthening rod extends caudad as far as sixth dorsal tooth. Toothed area on dorsal edge occupies about the apical fourth; eleven teeth present on each valve with a large median tooth present between teeth one and two;

apical teeth very small and broadly rounded, distal teeth larger and more sharply pointed; bear no secondary teeth; tip bears no teeth; area of ducts conspicuous, ducts elongate, rather straight, circular openings visible; open along ventral apical edge (twenty-two), at extreme apex (one), along dorsal edge of toothed area, very noticeably in teeth three and four, in each of which three to four ducts open, and in the basal rod; the two valves of the pair are joined one to the other by a distinct, elongate, narrow, heavily chitinized connection present on the dorsal edge of the basal rod.

Tinobregmus vittatus Van Duzee.

(Pl. XXXIII, fig. 1.)

Length, 2.7 mm.; greatest width, 0.19 mm. Long, narrow and rodlike, apical toothed portion only slightly wider than basal rod, tapers caudad at apex; no preapical prominence; distinctly curved, tip evenly narrowed, extreme apex rounded, chitinization moderately heavy, heavier than in *Jassus olitorius;* strengthening rod extends caudad as far as eighth dorsal tooth. Toothed area on dorsal edge occupies apical third; teeth ten to eleven in number, apical teeth small and broadly rounded, distal teeth larger and more sharply pointed; bear no secondary teeth; tip bears no teeth; area of ducts conspicuous, ducts elongate, rather straight, duct openings visible; open along ventral apical edges (twelve), at extreme apex (one), along dorsal edge of toothed area, and in the entire length of basal rod; the two valves of the pair are joined one to the other by a distinct, elongate, narrow, heavily chitinized connection present on the dorsal edge of the basal rod, occupying about one-fifth of the length of the basal shaft.

This ovipositor is very similar to that of *Jassus olitorius.*

Cicadula punctifrons var. *repleta* Fieber.

(Pl. XXIV, fig. 9; pl. XXXIII, fig. 3.)

Length, 2.2 mm.; greatest width, 0.17 mm. About the same width for entire length, narrows caudad at apex; no preapical prominence; slightly curved, tip narrowed by curving ventral edge, bears a finely toothed prominence on the dorsal edge, extreme apex narrowly rounded, chitinization very light; strengthening rod extends caudad as far as fourth dorsal tooth from apex. Toothed area on dorsal edge occupies the apical two-fifths; teeth fifteen in number, rather large, rounded, regular as to size, shape and spacing; bear a few fine secondary teeth on both edges, continuous around the apices of the primary teeth, those on caudal edge larger and more distinct than those on ventral edge, two to eight present on the ventral edge; there are fine, radiating lines extending from the interior of each tooth to the margin; the tip is notched with small teeth on both edges, not continuous around the tip, twenty-five on ventral edge; area of ducts inconspicuous, ducts invisible except for circular openings, which are easily visible; open along ventral apical edge (five), at extreme apex (one), along dorsal edge of toothed area, and in the basal area; the two valves of the pair are joined one to the other by a poorly defined, elongate, lightly chitinized connection present on the dorsal edge of the basal area, occupies about one-fourth the entire length.

Genus BALCLUTHA Kirkaldy.

The ovipositors of two species of this genus have been examined and found to be similar. The basal portion is somewhat narrower than the apical portion. The point of greatest width is between three-fourths and four-fifths the length of the valve, beyond which the valve tapers to a very narrow apex, sharply pointed or narrowly rounded. The valve bears only very small teeth located at the apex. The area of ducts may or may not be conspicuous, is granular in appearance with the duct openings visible. The two valves of the pair are joined one to the other by an elongate, lightly chitinized connection present on the dorsal edge of the basal area.

Balclutha punctata (Thunberg).

(Pl. XXIV, fig. 10; pl. XXXIII, fig. 4.)

Length, 0.88 mm.; greatest width, 0.1 mm. Apical portion somewhat wider than basal portion, point of greatest width about three-fourths the length, tapers caudad from this point to the apex; distinctly curved, tip greatly narrowed, extreme apex narrowly rounded, chitinization very light; strengthening rod extends caudad to within a short distance of the apex. The valve is toothed only on its dorsal apical edge for about one-sixth the length, teeth numerous, very small, regular; area of ducts inconspicuous, faintly granular in appearance, duct openings visible; open along ventral apical edge, at extreme apex, along dorsal apical edge, and in the basal region; the two valves of the pair are joined one to the other by a lightly chitinized, elongate, narrow connection present on the dorsal edge of the basal area.

Balclutha impicta (Van Duzee).

(Pl. XXIV, fig. 11; pl. XXXIII, fig. 5.)

Length, 0.88 mm.; greatest width, 0.09 mm. Apical portion slightly wider than basal portion, point of greatest width about four-fifths the length; only slightly curved, tip greatly narrowed, extreme apex very sharply pointed, chitinization light, though heavier than in *B. punctata;* strengthening rod extends caudad almost to apex. The dorsal edge is toothed only for the apical sixth of its length; teeth numerous, very small and regular; ventral edge also bears a few small teeth at the apex, farther apart than those on the dorsal edge, about ten in number; area of ducts conspicuous, granular in appearance, openings visible; open along ventral apical edge, at extreme apex, along dorsal apical edge, and in the basal area; the two valves of the pair are joined one to the other by a distinct, elongate, narrow connection present on the dorsal edge of the basal area.

Eugnathodus abdominalis (Van Duzee).

(Pl. XXIV, fig. 12; pl. XXXIII, fig. 6.)

Length, 0.72 mm.; greatest width, 0.09 mm. Apical half slightly wider than basal half, point of greatest width is about three-fourths the length, beyond this point the valve tapers to the apex; distinctly curved, tip greatly but unevenly narrowed, extreme apex very sharply pointed, chitinization very

light; strengthening rod extends caudad almost to apex. The toothed area on the dorsal edge occupies only the narrowed portion of the apex; these teeth are very small, regular, numerous; the ventral edge bears no teeth at the apex, but somewhat back from the apex on the widened portion the ventral edge is notched with many fine, indistinct teeth; area of ducts conspicuous, granular in appearance, duct openings visible; open along ventral apical edge, at extreme apex, along dorsal apical edge, and in basal region; there is no evidence of a chitinous connection between the two valves of the pair.

This ovipositor is similar in appearance to the ovipositors of the genus *Balclutha* examined.

TRIBE TYPHLOCYBINI (Kirschbaum).

Dikraneura abnormis (Walsh).

(Pl. XXIV, fig. 13; pl. XXXIII, fig. 7.)

Length, 0.7 mm.; greatest width, 0.08 mm. Basal half narrow and rodlike, apical half wider, flat, toothed, tapers caudad to apex; basal portion greatly curved, apical portion only slightly curved; tip greatly narrowed, extreme apex narrowly rounded, chitinization moderately light; strengthening rod extends caudad as far as sixth dorsal tooth from apex. Toothed area on dorsal edge occupies the apical half; the two valves of the pair are not identical as to teeth, the one having few and the other many; the one having more bears twenty-five primary teeth, these rather small, in the general shape of an obtuse triangle, fairly regular as to size and shape, much reduced in size apically; bear secondary teeth along the caudal edges, three to six in number; the tip is notched with small teeth on both edges, not continuous around the tip, four on the ventral edge; area of ducts inconspicuous, ducts visible, elongate, rather few in number; visible openings present only along dorsal edge of toothed area and in basal area; no distinct chitinous connection between the two valves present.

Genus EMPOASCA Walsh.

The ovipositors of five species of this genus have been examined and found to be very similar. In this genus the two valves of the pair are not identical, but differ in length, width, and size and number of teeth. The shorter, narrower valve bears many very small, regular teeth along its dorsal edge. The longer, broader valve bears comparatively few large teeth, which in turn bear small secondary teeth. Neither valve in any of the species examined bears teeth for more than the apical fifth of its length. Except in one species the tip of the valve is notched with small teeth. The area of ducts may or may not be conspicuous; ducts elongate, few in number.

Empoasca trifasciata Gillette.

(Pl. XXXIII, fig. 10.)

Length, 0.8 mm.; greatest width, 0.08 mm. Narrow and rodlike, apical toothed portion only slightly wider than basal shaft; distinctly curved, tip narrowed, extreme apex narrowly rounded, chitinization moderately light; strengthening rod extends caudad as far as second dorsal tooth. Toothed area

on dorsal edge occupies the apical fifth of the valve; the two valves of the pair differ as to number and arrangement of teeth; the shorter, narrower valve bears many small, regular teeth along its dorsal edge; the longer, broader valve bears thirteen large primary teeth along its dorsal edge, these rounded, regular, and bear one to three secondary teeth along their caudal edges; the tip is notched with small teeth on both dorsal and ventral edges, not continuous around the tip, seven on ventral edge of valve bearing small teeth, eleven on ventral edge of valve bearing large teeth; area of ducts conspicuous, ducts easily visible, elongate, rather few in number; open at apex, along dorsal edge of toothed area, and in basal area; no distinct chitinous connection present.

Empoasca smaragdula (Fallen).

(Pl. XXXIII, fig. 11.)

Length, 2 mm.; greatest width, 0.11 mm. Narrow and rodlike, about the same width for entire length, tapers caudad at apex; distinctly curved, tip narrowed, extreme apex narrowly rounded, chitinization medium; strengthening rod extends caudad as far as third dorsal tooth. Toothed area on dorsal edge occupies about the apical seventh of the length; the two valves of the pair are not identical; the one is shorter, narrower, and bears only very small teeth along its dorsal edge; the longer, wider valve bears thirteen large primary teeth along its dorsal edge, flatly rounded, fairly regular as to size, shape and spacing; bear a few indistinct secondary teeth; the tip of the larger valve is notched with small, indistinct, irregular teeth on both dorsal and ventral edges, continuous around the apex; area of ducts conspicuous, ducts easily visible, elongate, few in number; open at apex and along basal shaft; the dorsal edge of the basal shaft is irregularly roughened; no distinct chitinous connection present.

Empoasca obtusa Walsh.

(Pl. XXIV, fig. 14; pl. XXXIII, fig. 12.)

Length, 0.9 mm.; greatest width, 0.05 mm. Consists of a narrow, rodlike basal shaft and a slightly wider, toothed apical portion which tapers caudad to apex; distinctly curved, tip only slightly narrowed, extreme apex broadly rounded, chitinization moderately light; strengthening rod extends caudad as far as second dorsal tooth. The two valves of the pair are not identical; the shorter, narrower valve bears only very small, regular teeth along its dorsal edge; the longer, wider valve is toothed along its apical seventh with seven primary teeth, these of medium size, rather flatly rounded, fairly regular as to size, shape and spacing, though smaller apically, and bear a few irregular, indistinct, secondary teeth; no distinct teeth present on tip; area of ducts rather conspicuous, ducts visible, few in number, elongate; open apically, along dorsal edge of toothed area, and along basal shaft.

Empoasca livingstoni Gillette.

(Pl. XXXIII, fig. 14.)

Length, 2 mm.; greatest width, 0.11 mm. Narrow and rodlike, about the same width for entire length, tapers caudad at apex; distinctly curved, tip greatly narrowed, extreme apex ends in acute-angled point, chitinization very light; strengthening rod extends caudad as far as fifth dorsal tooth. The two valves of the pair are not identical; the shorter, narrower valve bears only

very small, regular teeth for a short distance on its dorsal edge; the longer, wider valve bears thirteen primary teeth along the apical sixth of its dorsal edge, medium in size, somewhat triangular in shape, with the caudal edge longer than the cephalic, fairly regular in size, shape and spacing; bear small secondary teeth along caudal edge, three to seven in number; tip of longer valve notched with small teeth, continuous around the tip, thirteen on ventral edge; area of ducts inconspicuous, ducts invisible except for circular openings; open at apex, along dorsal edge of toothed area, and in basal shaft.

Empoasca mali (LeBaron).

(Pl. XXXIII, fig. 13.)

Length, 0.8 mm.; greatest width, 0.03 mm. Very narrow and rodlike, apical toothed portion only very little wider than basal shaft; greatly curved, tip slightly narrowed, extreme apex narrowly rounded, chitinization light; strengthening rod extends caudad as far as third dorsal tooth. The two valves of the pair are not identical; the shorter, narrower valve bears only very small, regular teeth along its dorsal edge for a short distance; the longer, wider valve bears eighteen primary teeth along the apical sixth of its dorsal edge, these of medium size, regular as to size, shape and spacing, smaller apically, and bear a few very fine and indistinct secondary teeth on the caudal edge; the tip of the longer valve is notched with small teeth on both edges, not continuous around the tip, about seven on the ventral edge; area of ducts inconspicuous, ducts invisible except for circular openings; open at apex and a few in the basal shaft.

Genus ERYTHRONEURA Fitch.

The ovipositors of two species of this genus have been examined and found to be similar one to the other and also to the ovipositors of the genus *Empoasca*. In this genus the two valves of the pair are not identical, but differ as to length, width, and size and number of teeth. In one species the small, more numerous teeth are borne by the longer, wider valve; in the other species the condition is reversed. The teeth do not occur except on the apical fourth of the valve. The area of ducts is inconspicuous, ducts when visible elongate, duct openings visible.

Erythroneura tricincta Fitch.

(Pl. XXXIII, fig. 8.)

Length, 1.2 mm.; greatest width, 0.09 mm. Narrow and rodlike, the apical toothed portion only slightly wider than the basal shaft, tapers caudad at apex; distinctly curved, tip narrowed, extreme apex rounded, chitinization very light; strengthening rod extends caudad to a point about two-fifths the length of the toothed portion of the longer valve. The two valves of the pair are not identical; the longer, wider valve bears a great many very small, regular teeth along its dorsal edge for the apical fourth; the shorter, narrower valve bears slightly larger, less numerous, regular teeth along its dorsal apical edge; tip notched with teeth on both edges, not continuous around the tip,

about twelve on the ventral edge of the longer valve; area of ducts inconspicuous, ducts invisible except for openings; open in apex and along basal shaft.

Erythroneura vulnerata Fitch.

(Pl. XXXIII, fig. 9.)

Length, 0.8 mm.; greatest width, 0.06 mm. Narrow and rodlike, apical toothed portion only slightly wider than basal shaft, tapers caudad to apex; distinctly curved, tip narrowed, extreme apex rounded, chitinization moderately light; strengthening rod extends caudad as far as third dorsal tooth. The two valves of the pair are not identical; the shorter, narrower valve bears very small teeth for a short distance along its dorsal apical edge; the longer, wider valve bears ten primary teeth along its dorsal edge, occupying the apical sixth, these of medium size, in the general shape of an obtuse triangle, fairly regular in size, shape and spacing, bear two to five small secondary teeth on caudal edge; tip notched with small teeth on both edges, continuous around apex, about ten present on ventral edge of longer valve; area of ducts inconspicuous, ducts elongate; open apically and along the basal shaft.

CONCLUSIONS.

An examination of the descriptions and plates leads to several conclusions. The various subfamilies are not distinctly set apart by the characters of the ovipositor. While it is true that in general the ovipositors of the Bythoscopinæ have regular, rounded teeth; those of the Cicadellinæ are toothed for nearly their entire length and have elongate, curved ducts; those of the Gyponinæ are stout and heavily chitinized; and those of the Jassinæ have a granular duct area and a chitinous connection between the two valves of the pair; yet these characters are not found in all the members of the subfamily and are not exclusively found in the subfamily. However, closely related genera possess ovipositors which are very similar. Examples of this similarity are shown in *Agalliopsis* and *Aceratagallia; Macropsis* and *Oncopsis; Oncometopia, Homalodisca* and *Aulacizes; Cicadella* and *Graphocephala; Nephotettix* and *Driotura; Dorycephalus* and *Hecalus; Helochara* and *Dræculacephala; Jassus* and *Tinobregmus; Balclutha* and *Eugnathodus;* and *Dikraneura, Empoasca* and *Typhlocyba,* all in the tribe Typhlocybini, which is very clearly set apart by the characters of the ovipositor.

Between the species of well-defined genera there is an indisputable generic similarity. The characters of size, chitinization and number of teeth vary, but the characters of general shape, and shape and arrangement of teeth seem to be constant within the genus. Examples of generic similarity are shown in *Idiocerus, Macropsis, Kolla, Dræculacephala, Platymetopius, Deltocephalus, Balclutha,*

Empoasca, and many others. In the admittedly loose and complex genus *Euscelis* the ovipositors show the wide range of forms that would be expected, and the same condition might be found in other genera of equal complexity.

Finally, we find constant characters of specific value in the ovipositor. The ovipositors of seventeen individuals of *Cicadella hieroglyphica* (Say), representing as wide a geographical range and as many color varieties as are to be found in our duplicate collection, were examined and found to be constant in the characters given, which are sufficient to separate it from the other species of the genus examined. Several specimens each of *Graphocephala coccinea* (Forster) and *Oncometopia lateralis* (Fabricius) were examined in the same way and their characters also found to be constant. Hence it can safely be concluded that characters of specific value, constant within the range of the species, are found in the ovipositors of the Cicadellidæ. It is also true that these characters are accessible to the general worker and should not be neglected by him in a taxonomic study in this family.

BIBLIOGRAPHY.

1878—Packard: Guide to the Study of Insects.
1898—Marlatt: Periodical Cicada. U. S. Dept. of Agr., Bull. No. 14, n. s.
1909—Packard: Textbook of Entomology.
1910—Stough: Hackberry Psylla. Kansas U. Sci. Bull., vol. V, No. 9, p. 121.
1917—Van Duzee: Catalogue of Hemip. of N. A.
1918—Newell: Comp. Morph. of the Genitalia of Insects. Ann. Ent. Soc. Am., vol. XI, No. 2, p. 109.
1919—Kornhauser: Sexual Characters of Thelia. Journ. of Morph., vol. 32, No. 3, p. 531.
1919—Walker: Structure of Orthop. Insects. Ann. Ent. Soc. Am., vol. XII, No. 4, p. 267.
1920—Lawson: Cicadellidæ of Kansas. Kansas U. Sci. Bull., vol. XII, No. 1.
1921—Hilsman: Ovipositor of the Cicada. Thesis MS., University of Kansas.

PLATE XXI.

1. Ventral view of abdomen of female.
2. Dorsal view of abdomen of female.
3. Cross section through abdomen.
4. Dorsal view of segment nine, showing attachment of ovipositor.
5. Ventral view of segment nine, showing attachment of ovipositor.
6. Cross section through ovipositor, showing relative position of valves.
7. Valve I, showing attachment to eighth sternum.
8. Detached portion of valve I, showing attachment to ninth pleuron.
9. Valve II (upper) and valve I (lower), showing attachment to ninth sternum.

PLATE XXI.

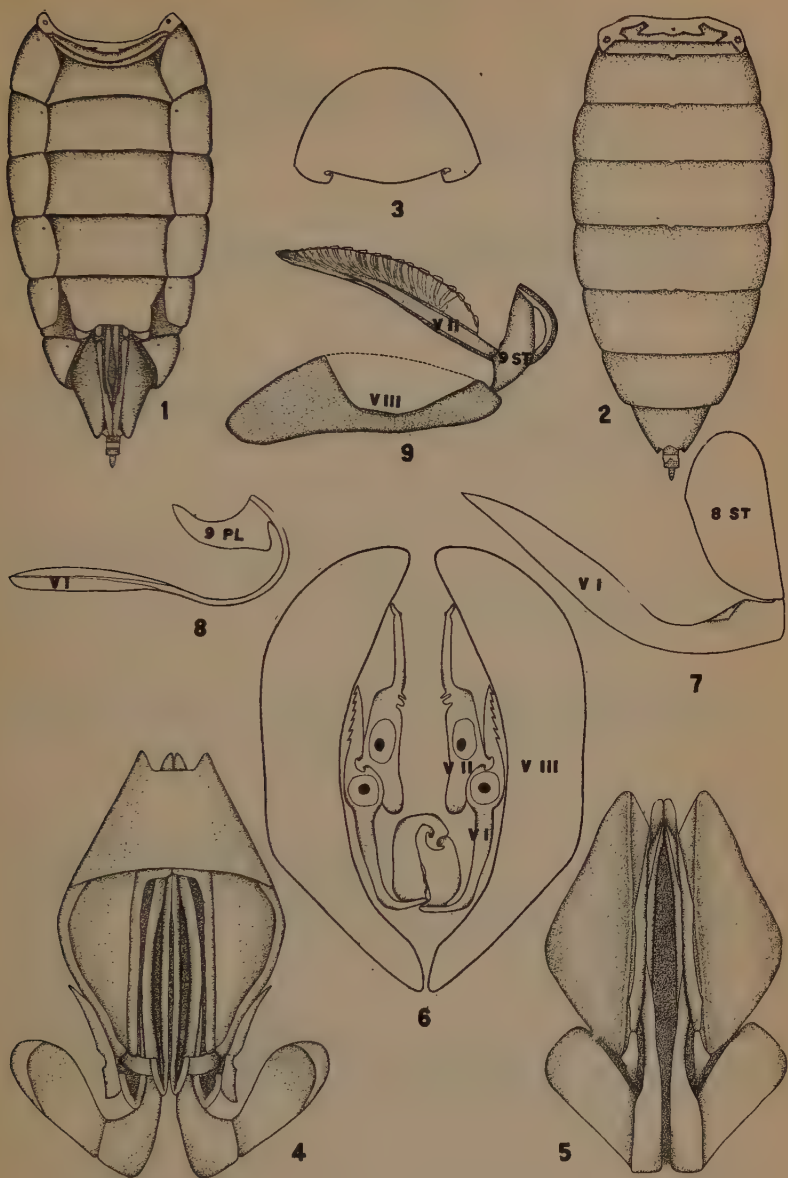


PLATE XXII.

1. *Idiocerus pallidus* Fitch.
2. *Agalliopsis novella* (Say).
3. *Oncometopia undata* (Fabricius).
4. *Oncometopia lateralis* (Fabricius).
5. *Homalodisca triquetra* (Fabricius).
6. *Aulacizes irrorata* (Fabricius).
7. *Cicadella hieroglyphica* (Say).
8. *Cicadella circellata* (Baker).
9. *Graphocephala coccinea* (Forster).
10. *Helochara communis* Fitch.
11. *Drœculacephala mollipes* (Say).
12. *Drœculacephala reticulata* (Signoret).
13. *Kolla bifida* (Say).
14. *Kolla hartii* (Ball).

PLATE XXII.

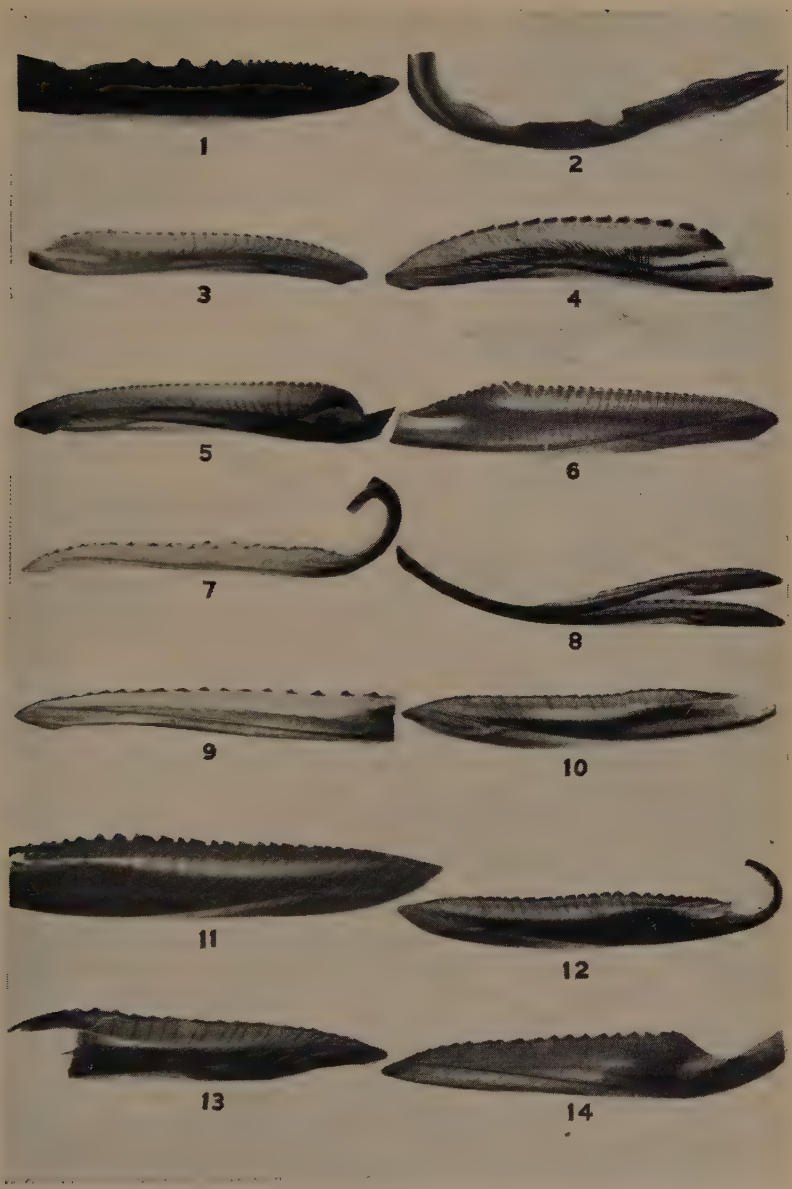


PLATE XXIII.

1. *Gypona octo-lineata* (Say).
2. *Xerophloea viridis* (Fabricius).
3. *Xestocephalus pulicarius* Van Duzee.
4. *Scaphoideus immistus* (Say).
5. *Platymetopius acutus* (Say).
6. *Platymetopius frontalis* Van Duzee.
7. *Mesamia vitellina* (Fitch).
8. *Deltocephalus inimicus* (Say).
9. *Deltocephalus flavicosta* Stal.
10. *Driotura gammaroides* (Van Duzee).
11. *Euscelis exitiosus* (Uhler).
12. *Euscelis striolus* (Fallen).
13. *Euscelis comma* (Van Duzee).
14. *Euscelis bicolor* (Van Duzee).

PLATE XXIII.

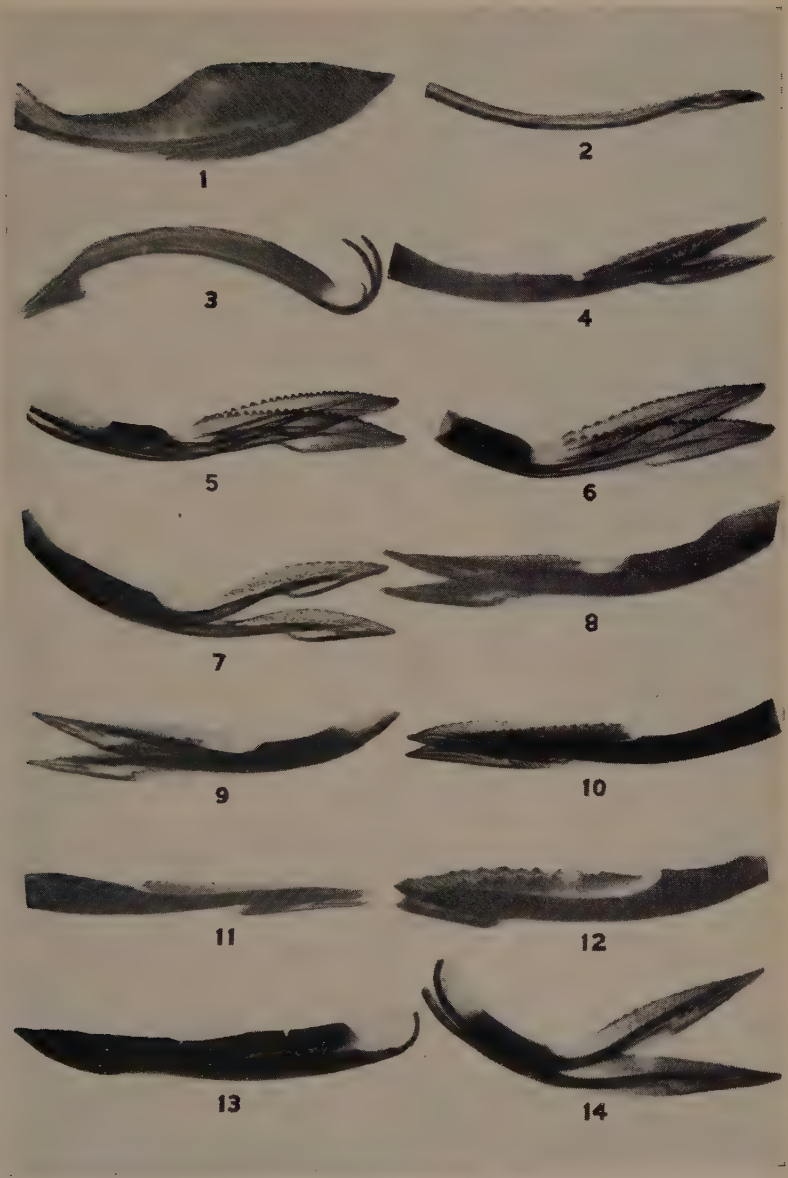


PLATE XXIV.

1. *Eutettix cinctus* Osborn and Ball.
2. *Eutettix strobi* (Fitch).
3. *Phlepsius spatulatus* Van Duzee.
4. *Phlepsius excultus* (Uhler).
5. *Phlepsius irroratus* (Say).
6. *Acinopterus acuminatus* Van Duzee.
7. *Chlorotettix spatulatus* Osborn and Ball.
8. *Chlorotettix galbanatus* Van Duzee.
9. *Cicadula punctifrons* var. *repleta* Fieber.
10. *Balclutha punctata* (Thunberg).
11. *Balclutha impicta* (Van Duzee).
12. *Eugnathodus abdominalis* (Van Duzee).
13. *Dikraneura abnormis* (Walsh).
14. *Empoasca obtusa* Walsh.

PLATE XXIV.

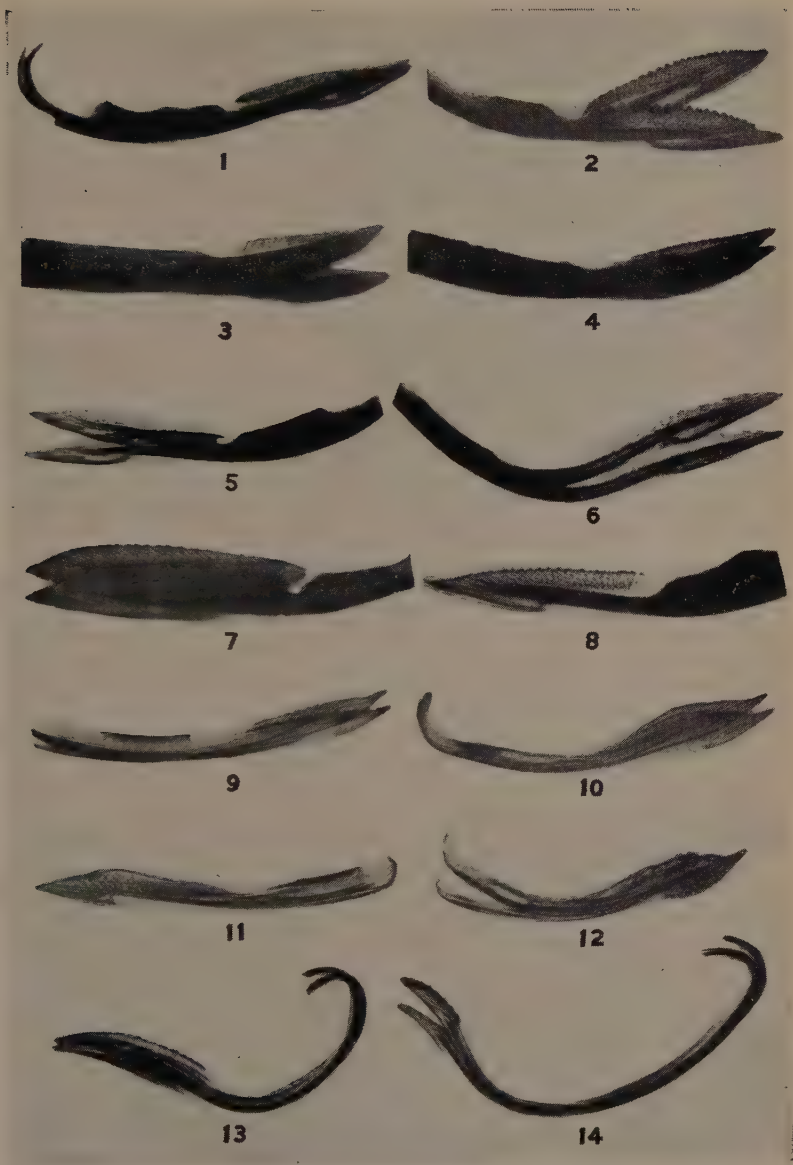


PLATE XXV.

1. *Agalliopsis novella* (Say).
2. *Aceratagallia uhleri* Van Duzee.
3. *Idiocerus snowi* Gillette and Baker.
4. *Idiocerus ramentosus* (Uhler).
5. *Idiocerus pallidus* Fitch.
6. *Idiocerus duzeei* Provancher.
7. *Idiocerus verticis* (Say).
8. *Idiocerus scurra* (Germar).
9. *Idiocerus nervatus* Van Duzee.
10. *Bythoscopus apicalis* (Osborn and Ball).
11. *Bythoscopus misellus* (Stal).

PLATE XXV.

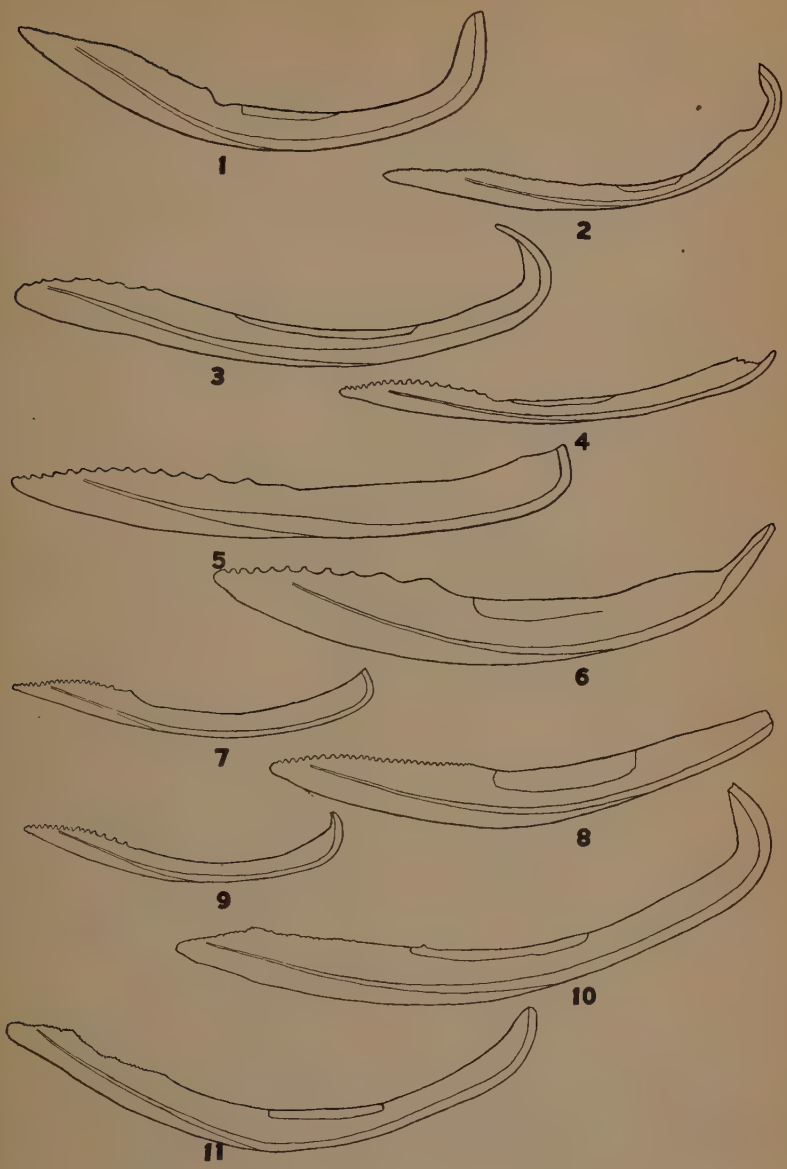


PLATE XXVI.

1. *Macropsis viridis* (Fitch).
2. *Macropis suturalis* (Osborn and Ball).
3. *Oncopsis distinctus* (Van Duzee).
4. *Oncometopia undata* (Fabricius).
5. *Oncometopia lateralis* (Fabricius).
6. *Homalodisca triquetra* (Fabricius).
7. *Aulacizes irrorata* (Fabricius).
8. *Cicadella circellata* (Baker).
9. *Cicadella hieroglyphica* (Say).

PLATE XXVI.

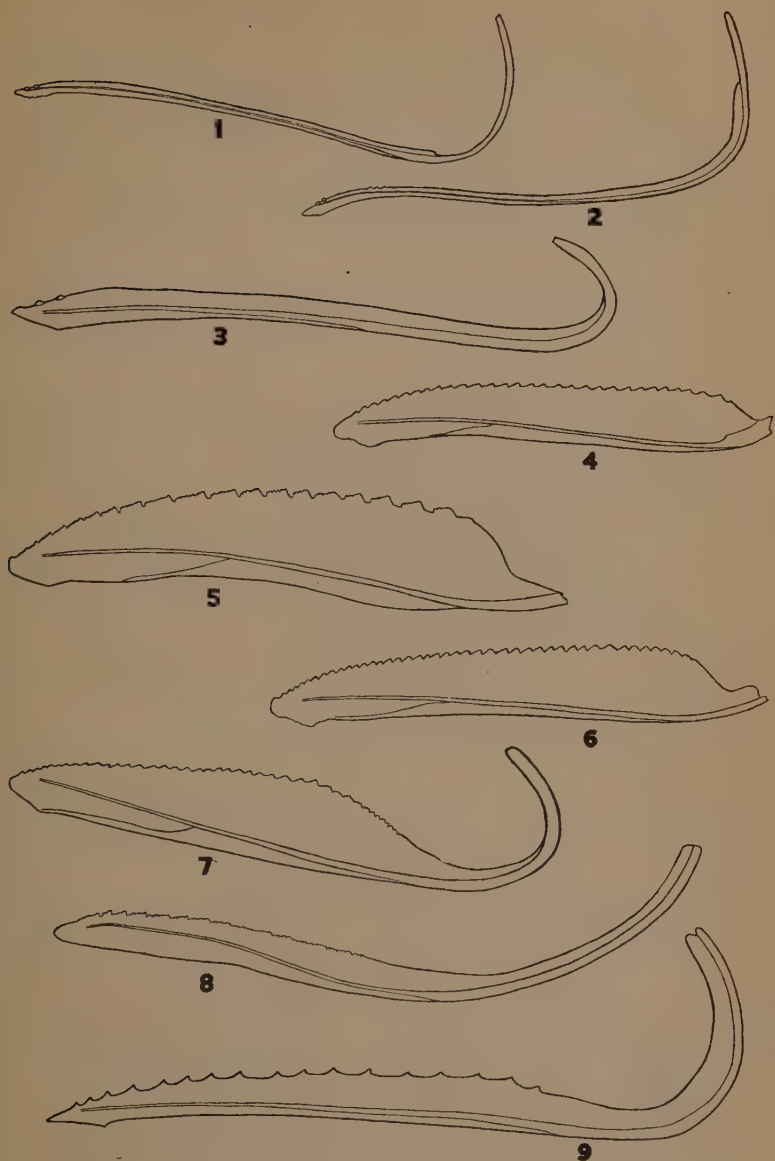


PLATE XXVII.

1. *Dræculacephala noveboracensis* (Fitch).
2. *Dræculacephala mollipes* (Say).
3. *Dræculacephala reticulata* (Signoret).
4. *Errhomenellus montanus* Baker.
5. *Helochara communis* Fitch.
6. *Pagaronia tripunctata* (Fitch).

PLATE XXVII.

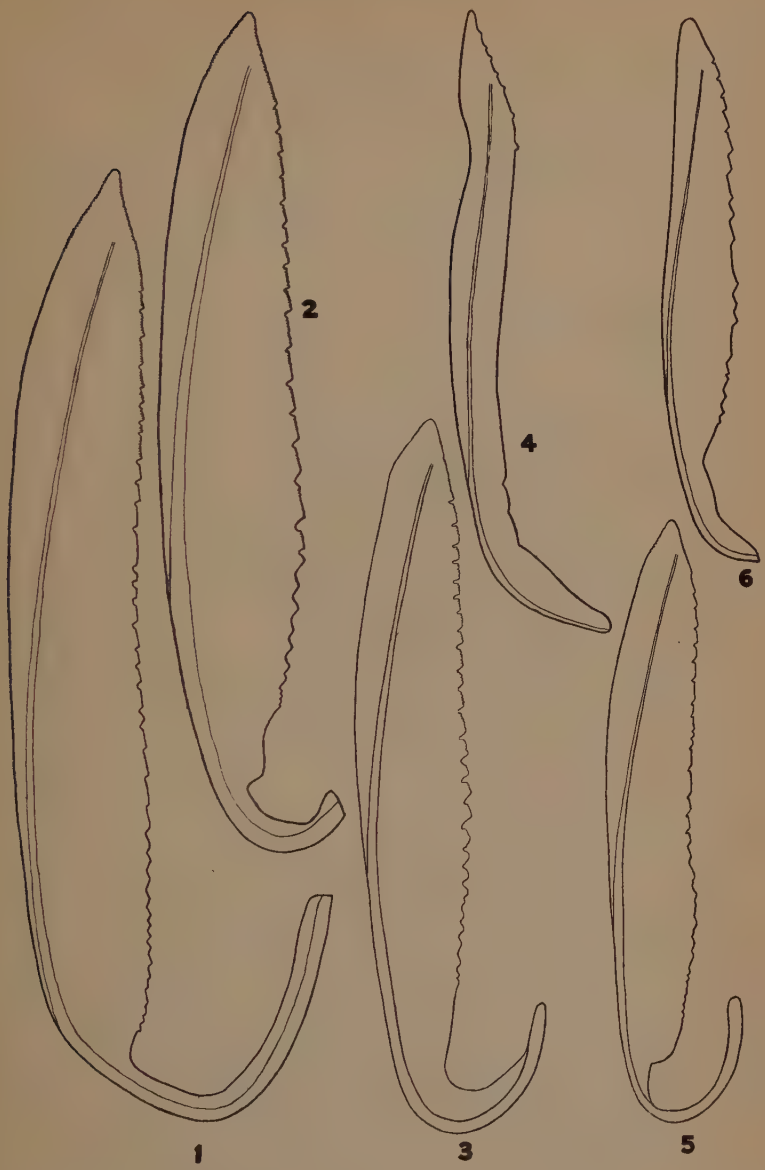


PLATE XXVIII.

1. *Kolla hartii* (Ball).
2. *Kolla geometrica* (Signoret).
3. *Kolla bifida* (Say).
4. *Graphocephala coccinea* (Forster).
5. *Gypona bimaculata* Spangberg.
6. *Gypona angulata* Spangberg.
7. *Gypona pectoralis* Spangberg.
8. *Gypona octo-lineata* (Say).

PLATE XXVIII.

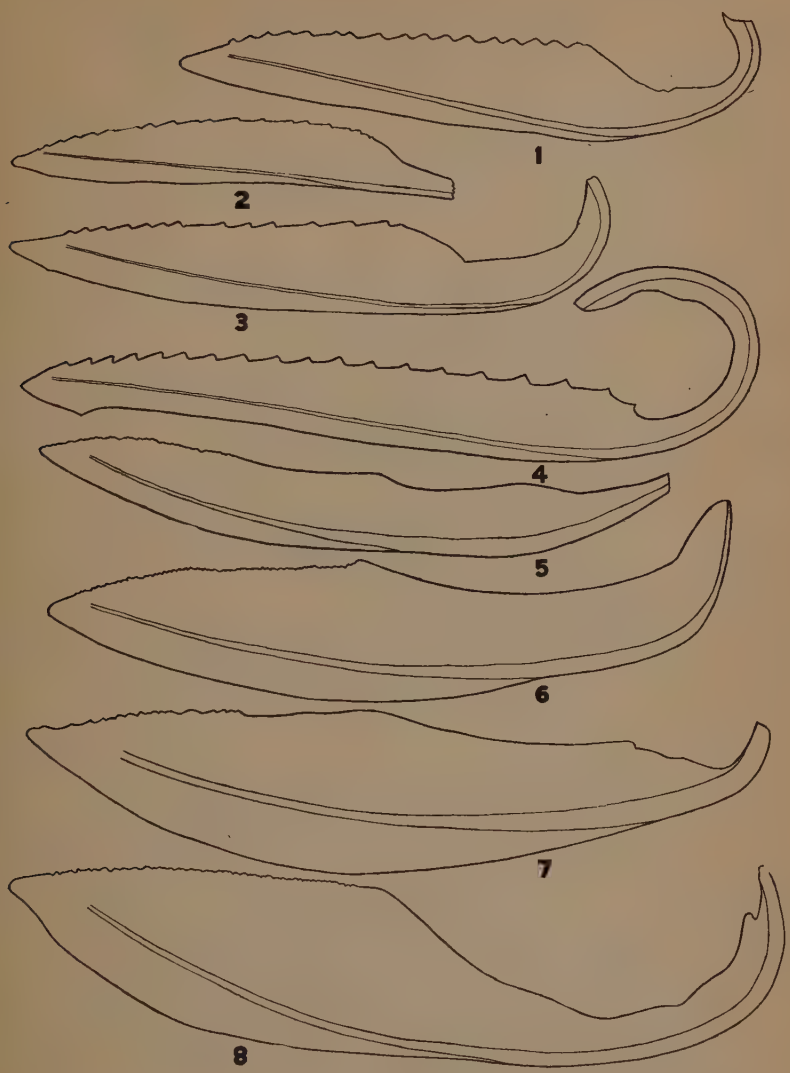


PLATE XXIX.

1. *Xestocephalus pulicarius* Van Duzee.
2. *Xerophlœa viridis* (Fabricius).
3. *Stroggylocephalus agrestis* (Fallen).
4. *Dorycephalus platyrhynchus* Osborn.
5. *Memnonia consobrina* Ball.
6. *Spangbergiella mexicana* Baker.
7. *Parabolocratus flavidus* Signoret.
8. *Hecalus lineatus* (Uhler).
9. *Mesamia straminea* (Osborn).
10. *Mesamia vitellina* (Fitch).
11. *Aligia jucunda* (Uhler).

PLATE XXIX.

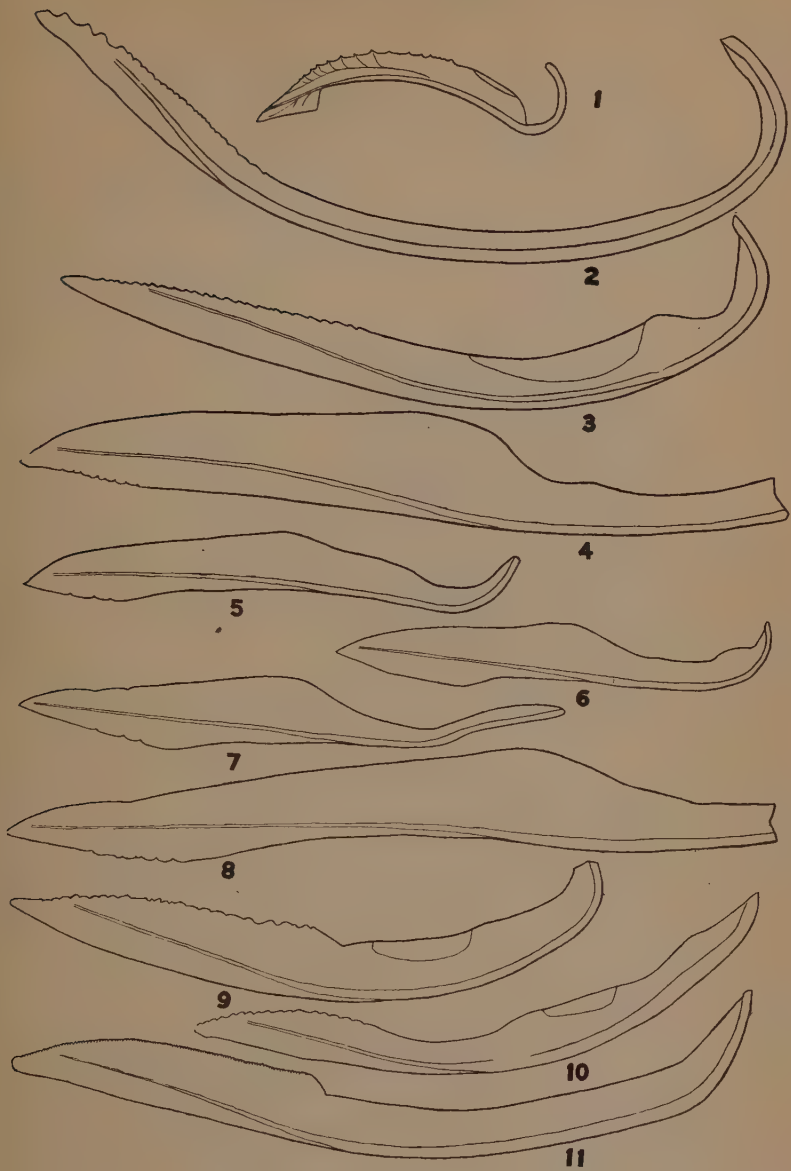


PLATE XXX.

1. *Scaphoideus scalaris* Van Duzee.
2. *Scaphoideus immistus* (Say).
3. *Platymetopius acutus* (Say).
4. *Platymetopius cinereus* Osborn and Ball.
5. *Platymetopius frontalis* Van Duzee.
6. *Deltocephalus reflexus* Osborn and Ball.
7. *Deltocephalus weedi* Van Duzee.
8. *Deltocephalus inimicus* (Say).
9. *Deltocephalus flavicosta* Stal.
10. *Deltocephalus debilis* Uhler.
11. *Deltocephalus parvulus* Gillette.
12. *Deltocephalus collinus* Boheman.

PLATE XXX.

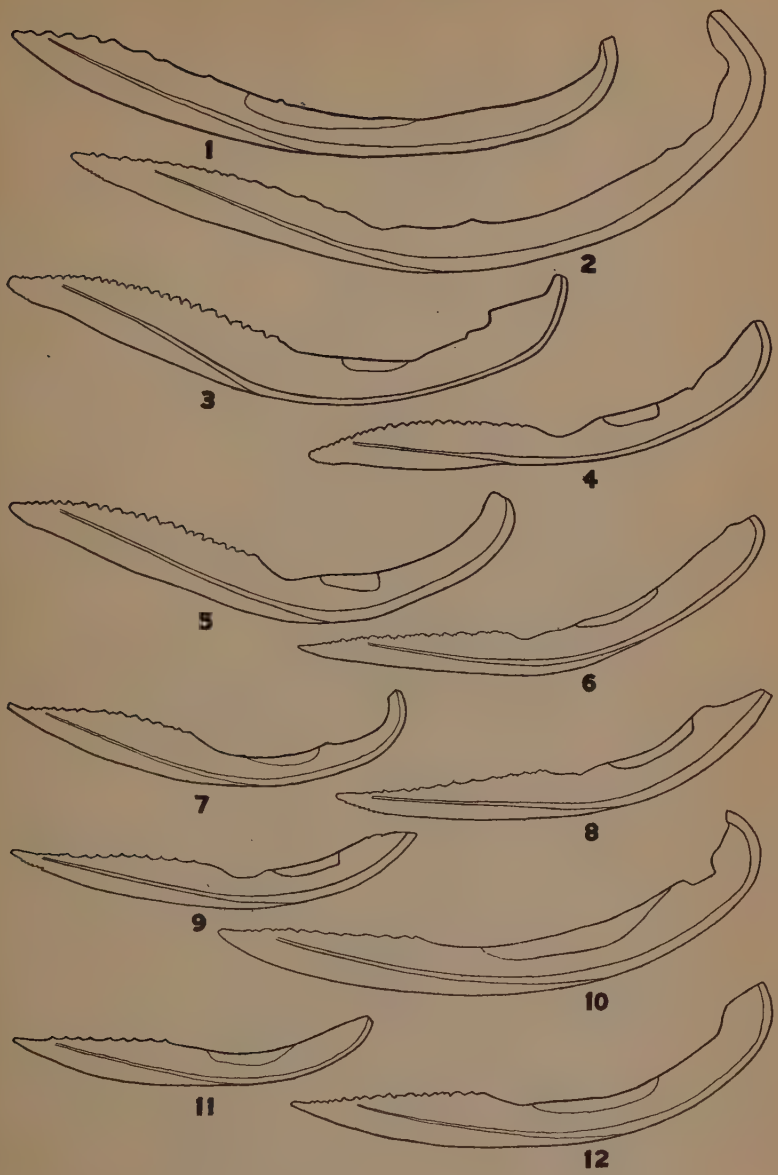


PLATE XXXI.

1. *Euscelis exitiosus* (Uhler).
2. *Euscelis striolus* (Fallen).
3. *Euscelis anthracinus* (Van Duzee)
4. *Euscelis comma* (Van Duzee).
5. *Euscelis curtisii* (Fitch).
6. *Euscelis bicolor* (Van Duzee).
7. *Eutettix strobi* (Fitch).
8. *Eutettix cinctus* Osborn and Ball.
9. *Aconura argenteolus* (Uhler).
10. *Nephotettix curtipennis* (Gillette and Baker).
11. *Driotura gammaroides* (Van Duzee).

PLATE XXXI.

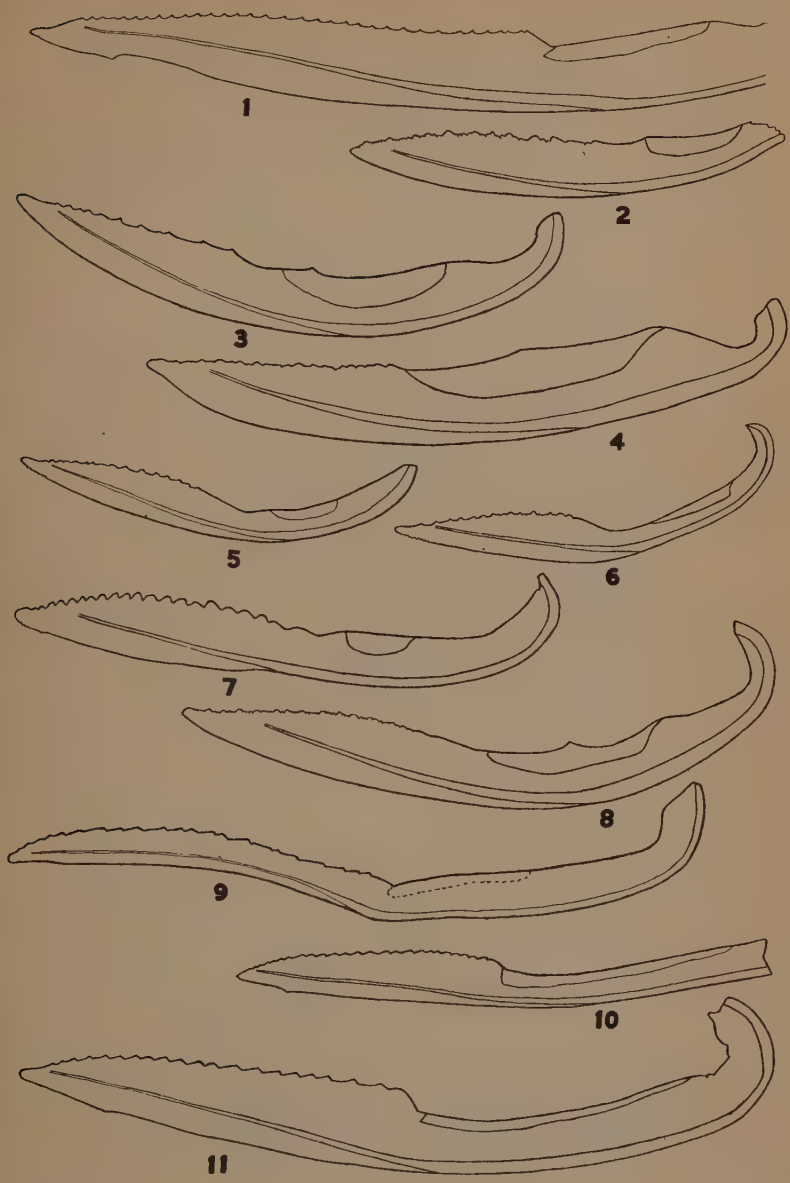


PLATE XXXII.

1. *Acinopterus viridis* Ball.
2. *Acinopterus angulatus* Lawson.
3. *Acinopterus acuminatus* Van Duzee.
4. *Thamnotettix longulus* Gillette and Baker.
5. *Thamnotettix clitellarius* (Say).
6. *Chlorotettix spatulatus* Osborn and Ball.
7. *Chlorotettix galbanatus* Van Duzee.
8. *Phlepsius irroratus* (Say).
9. *Phlepsius excultus* (Uhler).
10. *Phlepsius spatulatus* Van Duzee.

PLATE XXXII.

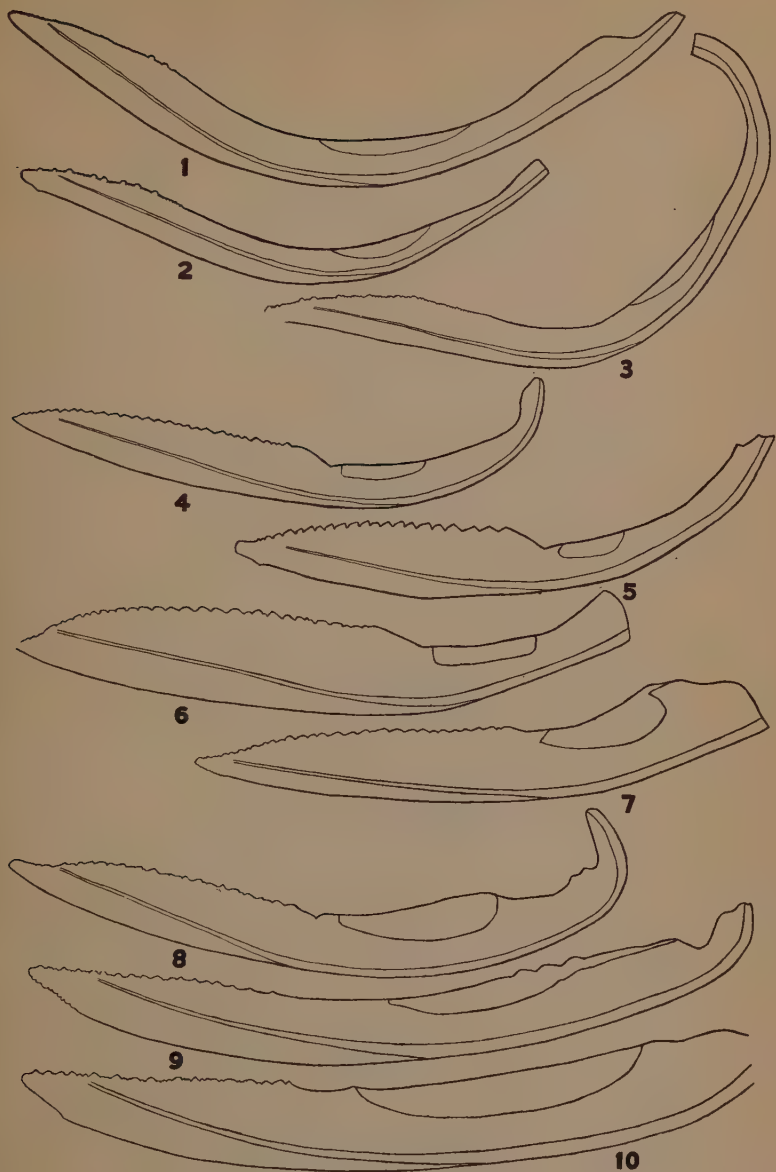
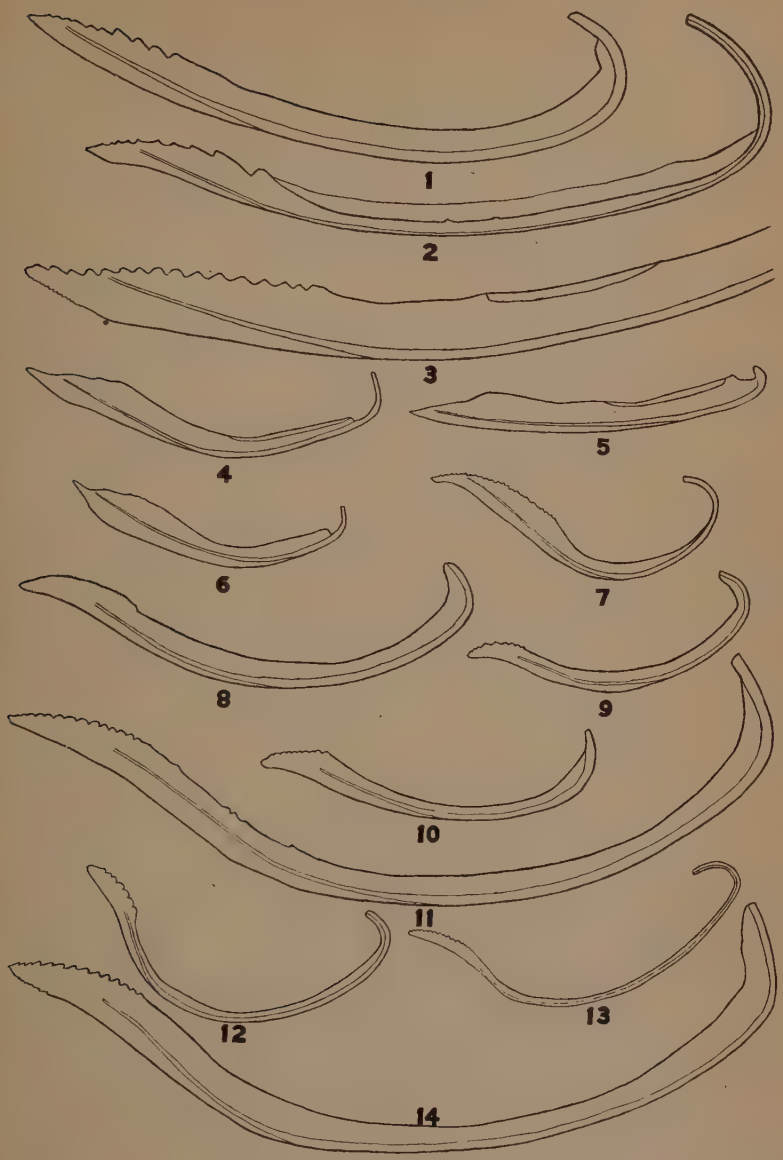


PLATE XXXIII.

1. *Tinobregmus vittatus* Van Duzee.
2. *Jassus olitorius* Say.
3. *Cicadula punctifrons* var. *repleta* Fieber.
4. *Balclutha punctata* (Thunberg).
5. *Balclutha impicta* (Van Duzee).
6. *Eugnathodus abdominalis* (Van Duzee).
7. *Dikraneura abnormis* (Walsh).
8. *Erythroneura tricincta* Fitch.
9. *Erythroneura vulnerata* Fitch.
10. *Empoasca trifasciata* Gillette.
11. *Empoasca smaragdula* (Fallen).
12. *Empoasca obtusa* Walsh.
13. *Empoasca mali* (Le Baron).
14. *Empoasca livingstoni* Gillette.

PLATE XXXIII.



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